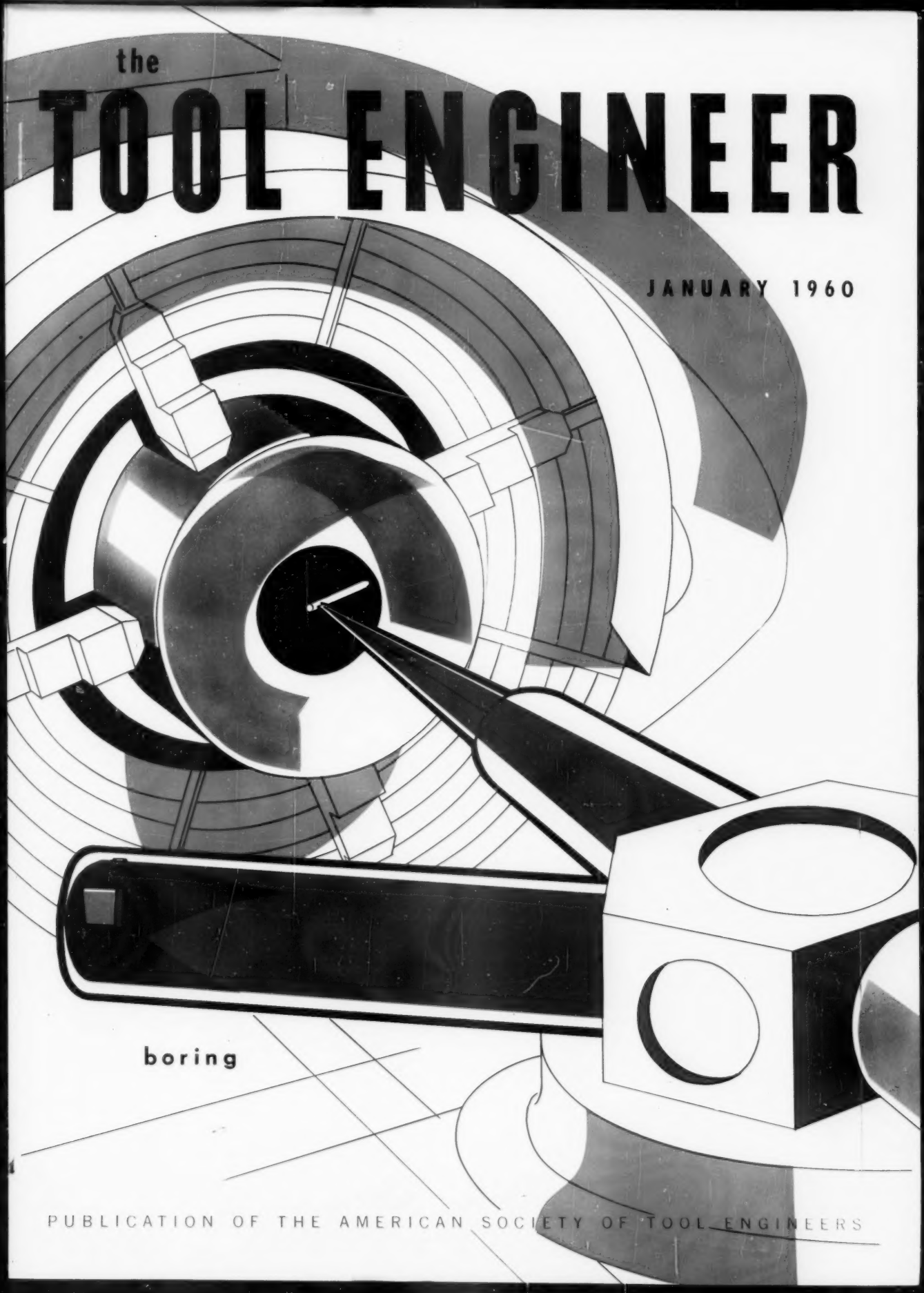
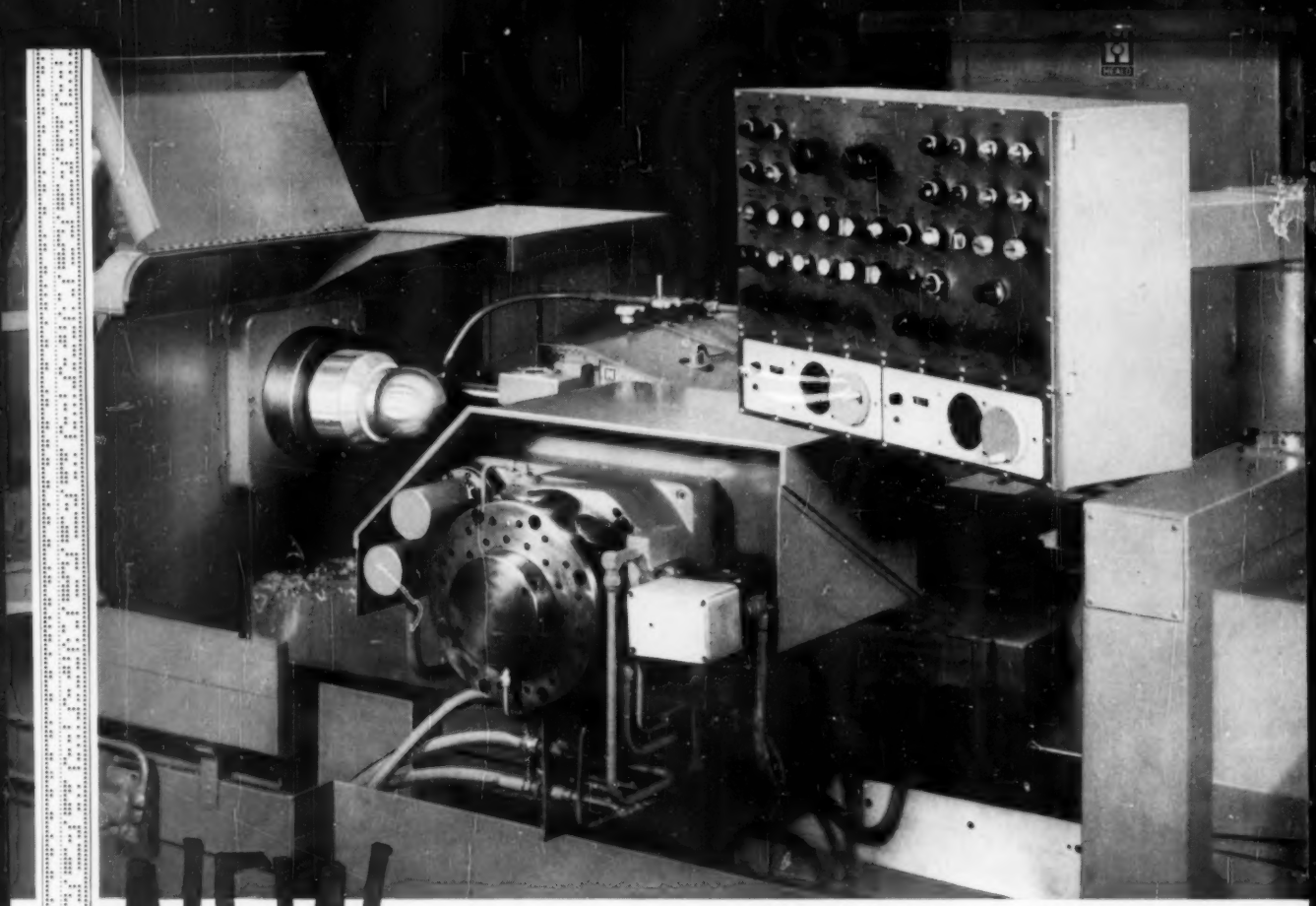
the TOOL ENGINEER

JANUARY 1960



boring

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS



This numerically-controlled Model S Bore-Matic operates in an air-conditioned, temperature-stabilized cubicle to maintain the extremely high precision of which the machine is capable.

NEW TAPE-CONTROLLED BORE-MATICS

precision bore and turn free contours to ±.0001"

ON THE NEW, numerically-controlled Heald Model S Bore-Matics, free-form shaped parts are borized in production with a heretofore unattainable degree of accuracy and precision. Tool motion and work speed are automatically controlled throughout the entire cycle, in increments so small that contours are generated with a dimensional tolerance of ± .0001". These Model S machines have been supplied in several sizes, with various types of numerical control, and are now in successful operation on a number of classified projects.

The machine shown above, with 20" table stroke and 15" cross slide travel, is arranged for punched tape control using Cincinnati Milling Machine Company's Acramatic system. Table and cross slide are actuated by preloaded, re-circulating ball nut precision lead screws with hydraulic motor drive. Pressure lubricated box-type ways track to an accuracy of 25 millionths in 20 inches of travel. The specially designed work spindle turns within 30 millionths for total runout, and is driven by a cam-controlled variable speed unit arranged to maintain the proper cutting speeds for any given point on the workpiece contour.

For further details on numerically-controlled Model S Bore-Matics, contact your Heald engineer or write to The Heald Machine Company, Worcester, Mass.

It PAYS to come to Heald

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Subsidiary of The Cincinnati Milling Machine Co.

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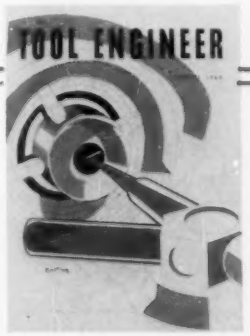
HEALD MMT=PE

the tool engineer

Vol. 44, No. 1
January 1960

Creative Manufacturing IS TOOL ENGINEERING

THIS MONTH'S COVER

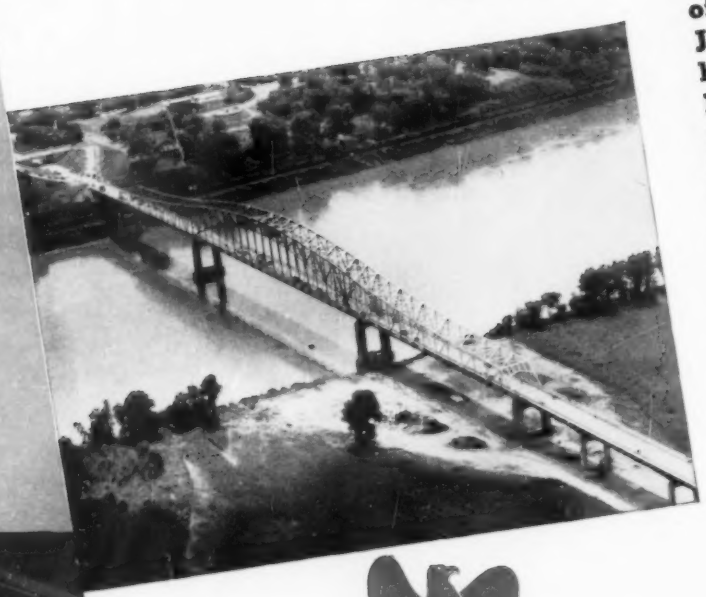


Accuracy required when boring the powder chambers of gun tubes is symbolized in this drawing of an inspection probe checking dimensions subsequent to machining. The boring bar in the foreground is solid carbide and was developed by Kennametal, Inc. Results obtained with this boring bar at Watervliet Arsenal are discussed in the article starting on page 98.

THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and *Applied Science & Technology Index*. The magazine is available to libraries and other institutions in microfilm form.

THE THOUSANDS OF HOLES

required in the construction of the recently completed Jefferson City, Missouri bridge by Stupp Bros. Bridge and Iron Company, of St. Louis, Missouri, were all drilled by "AMERICAN" Hole Wizard Radials.

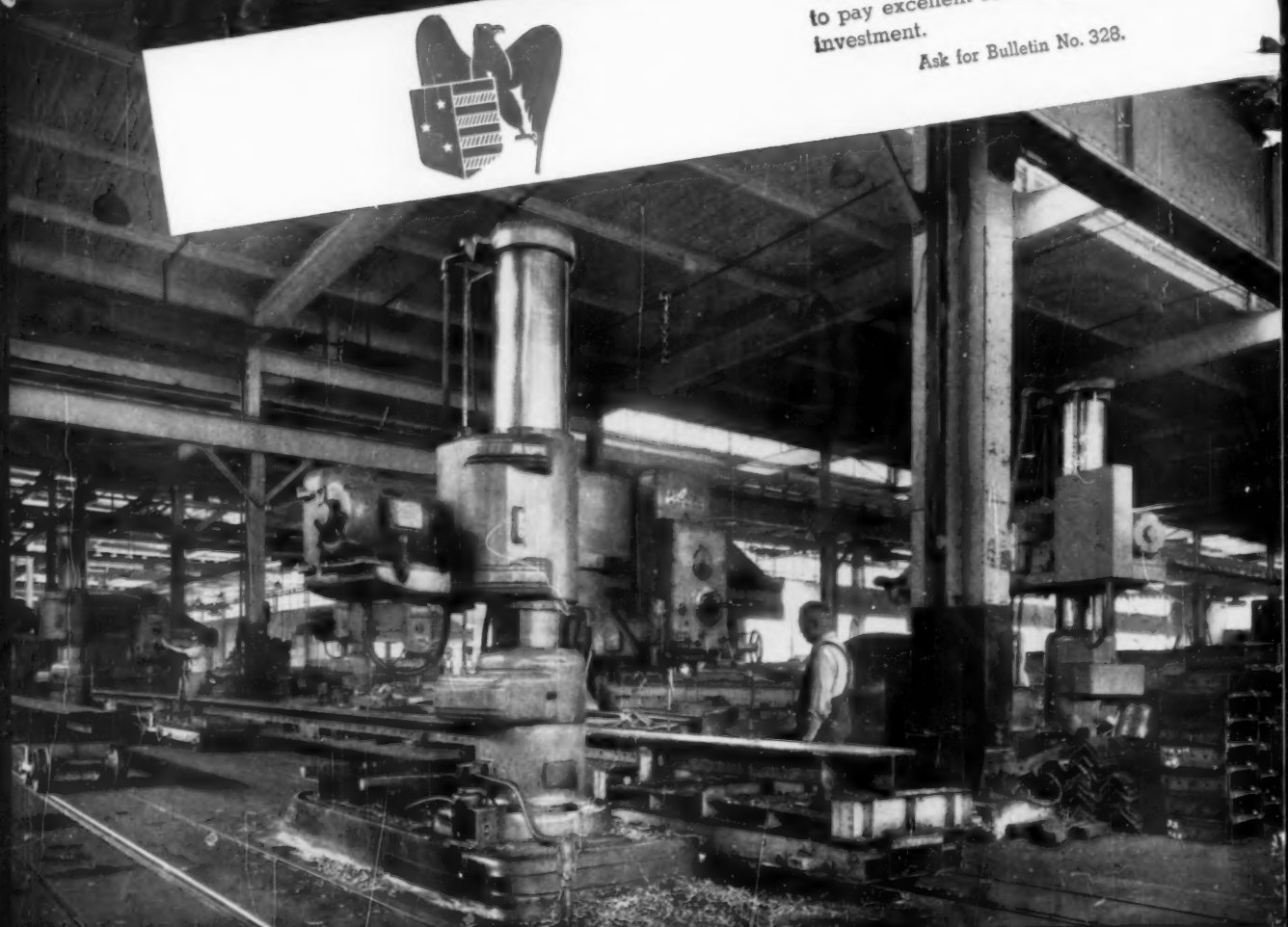


One of the oldest and largest bridge builders and steel fabricators of the Middle West, Stupp Bros. use "AMERICAN" radials exclusively for their drilling operations. Their main reason for using "AMERICAN" exclusively is LOW COST PER HOLE.

Quick Handling—Fast Penetration—Low Maintenance are the prominent contributing factors.

"AMERICAN" Radials can be relied upon to pay excellent returns upon the user's investment.

Ask for Bulletin No. 328.



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What is Economic Good?

Economists have said that 1961 will be a critical year. It will be the time for a showdown. Competition between domestically produced goods and foreign-produced products will reach a crisis. World leadership will lie in the balance.

Product designers and tool engineers have each contributed the benefits of experience for the good of industry. This has continued at an accelerating rate during the past twenty-five years. Achievements have been outstanding. The tool engineer has been able to develop better processes and to apply more automation to production lines than ever before.

For limited quantity production, he has also contributed immeasurably to cost savings by the application of numerical control. Quality control has proved a priceless byproduct. These and other developments have made American products the envy of the world. Records show that the engineering professions have contributed nobly to our economy. Their contributions proved to be investments that have returned compounded dividends.

Now economists imply that these outstanding contributions have merely kept up with inflation. They suggest that we may be fighting a losing battle economically with foreign goods. They point to signs of new products competing in fields that have traditionally been American and cite machine tools as an example.

Comparison of the fruits of our labor with those of its foreign counterpart indicates the importance of productivity in the race for survival. There should be no quarter for mock-work, featherbedding or any unwarranted luxury. Any attitude demanding a bigger piece of pie than that justified cannot be tolerated.

The biggest benefit of any cost saving should always go to the customer. When that happens everyone profits. The natural result is a stronger economy. Then foreign competition is not dangerous but healthy. The selection becomes bigger. The choice can be nothing but better.

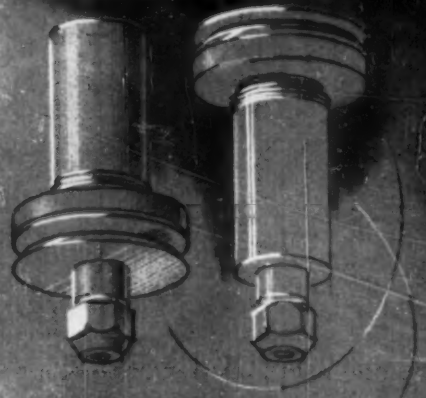
John W Greve

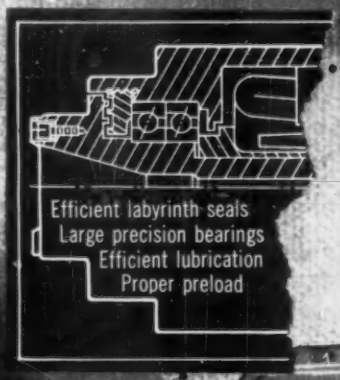
EDITOR

Every Whitnon milling spindle comes with something extra

Close tolerances, precision bearings, the right preload, perfect balance . . . all these go into every Whitnon spindle, along with something extra: our proud determination that every spindle labeled Whitnon will be the best of its type. Catalog #59 is available now. Ask for it.

Whitnon special engraver spindle with pulley at either end, to best suit the clearance and vision requirements of work. Speeds to 28,000. Style B-176.





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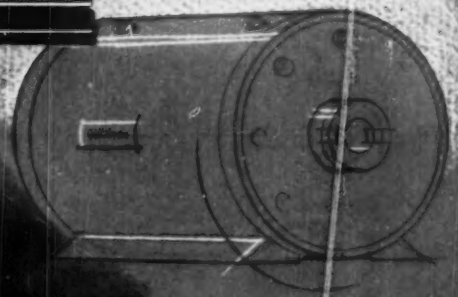

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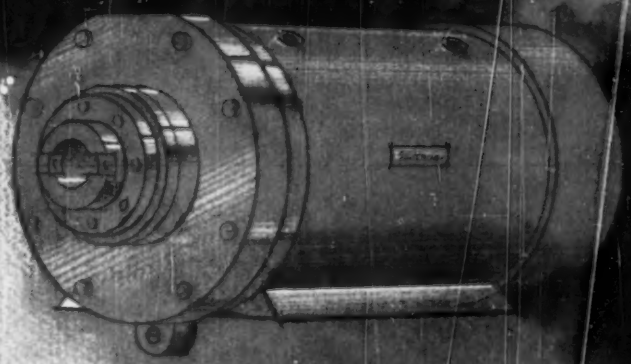
Brute force skin milling spindles with all the usual Whitnon accuracy, and speeds to 12,000 rpm. Investigate series E-100.

50 TO 200 HP



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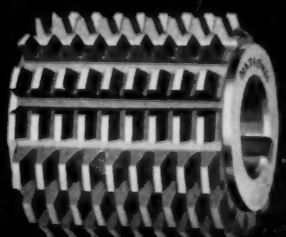

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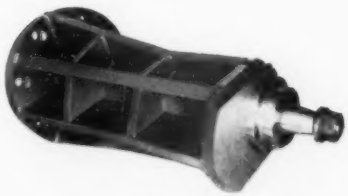
POPE P-18670 Heavy Duty, High Speed Milling Spindle, 4 ft. long, 10 in. dia.; weight about 1000 lbs.

POPE P-18844 Vertical Bearing Grinder Spindle, 20 HP, 6 ft. long, 12 in. dia. barrel; weight approx. 4000 lbs.

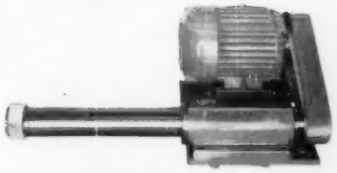
POPE P-1076 Cylindrical Grinding Spindle, designed for crush dressing and form grinding; 5 ft. long, 10 in. dia. barrel, for 24 in. dia.; 4 in. wide wheel; weight about 1250 lbs.

POPE P-18842 Deep Hole Internal Grinding Spindle, 10 HP, 7 ft. long, 12 in. dia. barrel; weight 4000 lbs.



POPE P-1098 Heavy Duty Internal and External Grinding Spindle, 50 HP, for wheel of 30 in. dia. and 12 in. width; weight approx. 6000 lbs.

POPE P-A1 Deep Hole, Ram Type Grinding Spindle attached to boring machine, 10 HP, 10 ft. long, 10 in. dia. barrel; weight 2000 lbs. (For purposes of comparison, a Pope P-32 6″ x 18″ Surface Grinder Spindle is shown in the foreground.)



POPE P-5794B Motorized Deep Hole Grinding Spindle, 10 HP, 36 in. long, 6 in. dia. barrel, for use in horizontal or vertical position on boring mills or planers; weight about 800 lbs.

POPE P-10009E Motorized Deep Hole Grinding Spindle, 5 HP, 36 in. long, 5 in. dia. barrel; weight 600 lbs.

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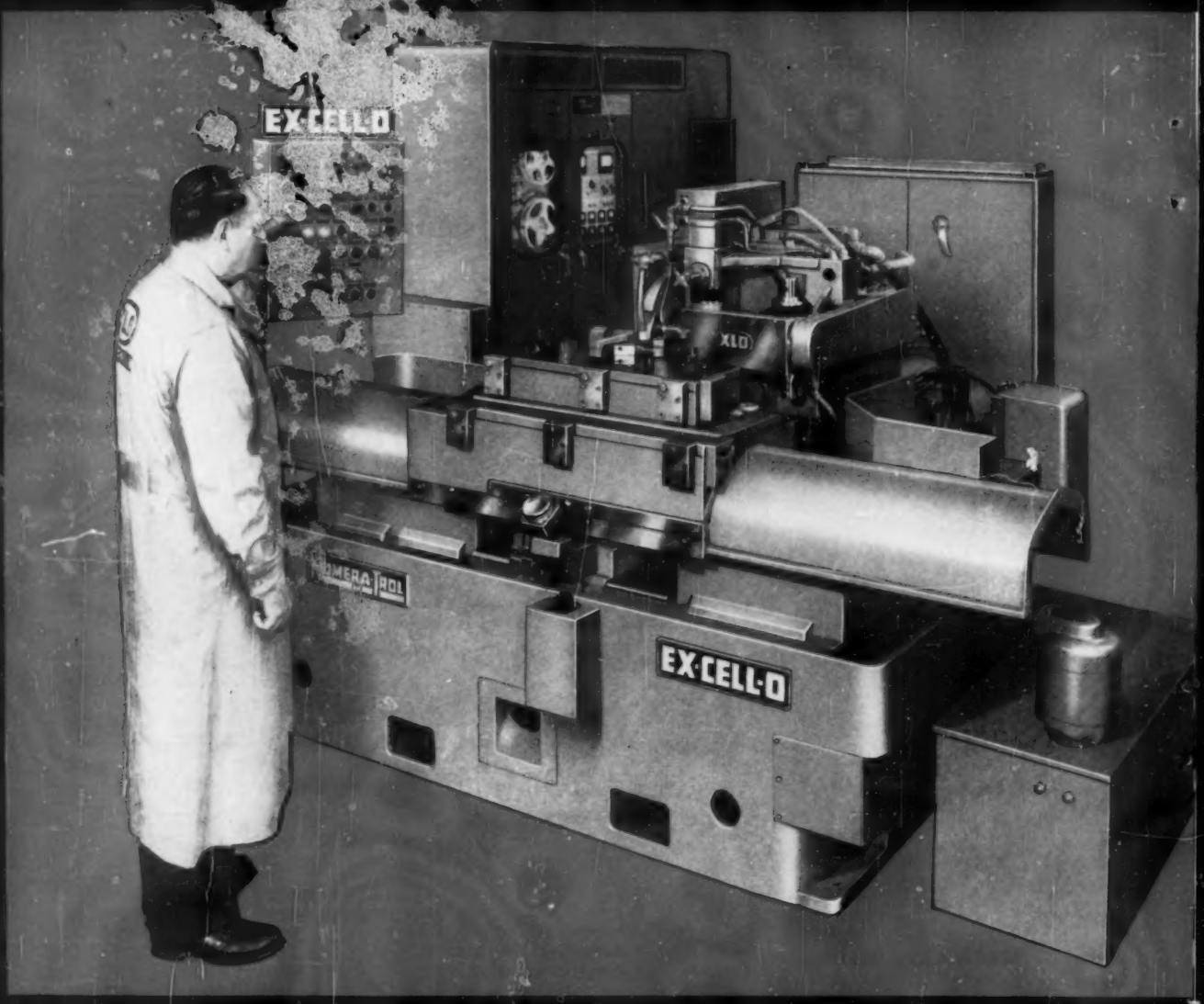

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Plus versatility— Interchangeable Units for tape-controlled Grinding, Turning and Boring

SPACE-AGE ACCURACY—**The Standard 922 Contouring Machine's main slide and cross slide are controllable in increments of .000025" automatically or manually. Dial the dimension, from .000025" to .10", and the main slide or cross slide of this two-axis machine advances or retracts by that amount—exactly!**

ECONOMY, VERSATILITY—**Building-block construction permits changing in minutes from a precision grinding assembly to a precision turning-boring unit. Unitized design adds versatility, cuts downtime.**

FULLY TAPE-CONTROLLED—**Used with high-performance pulse data input, the Standard 922 provides fully automatic turning, boring and grinding, plus wheel dressing and dressing compensation.**

TOMORROW'S MACHINES, TODAY—**The Standard 922 is the latest in a line of Numera-Trol Machines performance-proved in customers' plants. Others include Precision Milling and Grinding Machines for machining turbine blades, small cams and other prototypes and production parts.**

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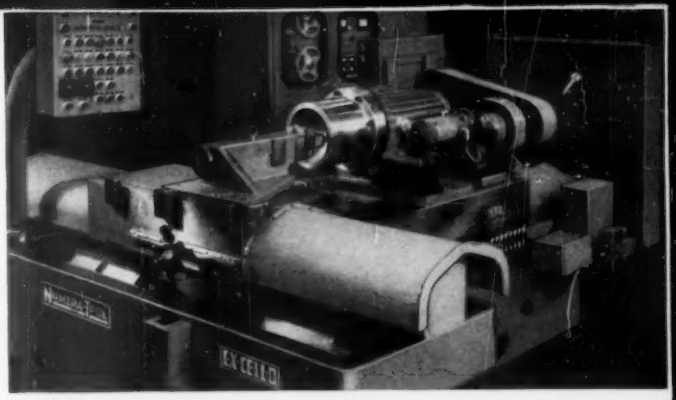
Standard Numera-Trol 922 equipped with grinding unit for precision templet grinding. Grinding assembly is easily interchangeable with boring and turning unit for accurate contouring operations.

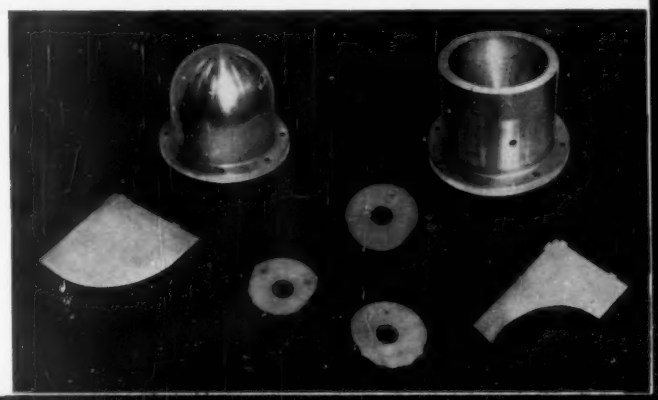
Machine is equipped for contouring by mounting boring and turning unit on main slide and tool holder on cross slide. Spindle speeds are automatically varied to maintain constant cutting speeds.



Operation is monitored by electronic "Nixie" counting tubes and by direct-reading optical vernier. This mechanical and electronic read-out combination gives "closed loop" accuracy control during all operations.

Numera-Trol Contouring Machine simplifies production of parts with complex contours, ends need for blueprints and models, permits fabrication of prototypes and production parts directly from designer's mathematical directions.

By setting dial and pressing button either slide can be moved in increments ranging from .000025" to .10" with total movement of 18" on main slide and 26" on cross slide.



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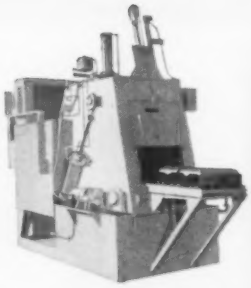
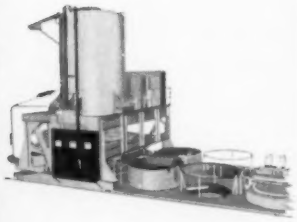
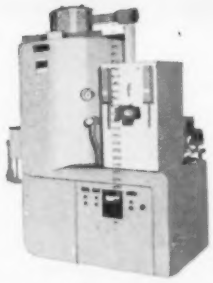
Laboratory Equipment: One-unit box furnace (shown), muffle or for non-oxidizing atmosphere with temperature range to 3000° F.



Automatic Carbonitriding Furnaces: Automated integral quench type (shown) with CORRTHERM electric elements.

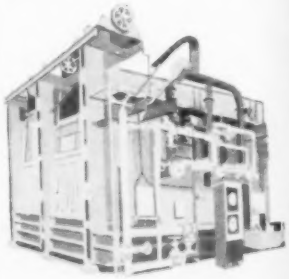


Gantry Type Furnaces: Vertical, controlled-atmosphere, drop bottom, hardening furnace (shown). Complete installation field-installed by Lindberg.

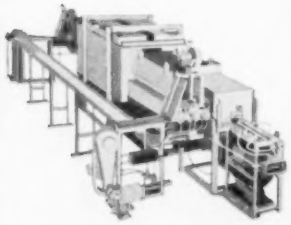


Atmosphere Generators: Hyen generator (shown) for endothermic atmospheres. Generators for all required atmospheres.

Melting and Holding Furnaces: Electric resistance furnace (shown) with capacities of 750 lbs. to 1500 lbs.



Aluminum Reverberatory Furnaces: Twin-chamber melting and holding furnace (shown) with 45,000 lbs. capacity.



Ceramic Kilns: Fully automatic, atmosphere controlled kiln (shown) has 5 control zones for flexibility. Maximum temperature, 2700° F.

Cyclone Tempering Furnaces: Batch type fuel fired tempering furnace (shown). Famous in metal treating industry for years.

When a product needs heat let Lindberg apply it

Applying heat to industry has been our only vocation for many years. When your product needs heat it makes sense to consult the most widely experienced experts you can find. We believe we have them here at Lindberg. First of all, we manufacture a full line of equipment, the most complete in the field; heat treating furnaces, salt bath furnaces, melting furnaces, induction heating units, ceramic kilns, laboratory and pilot plant furnaces—electric or fuel fired, built in our plant or field installed. So, we can recommend just the correct techniques best suited to your individual requirements and your production methods. Here at Lindberg we have an exceptionally creative group of metallurgists, research technicians and engineers, the best in the business, we vow. You can count on them to answer your industrial heating problems satisfactorily, no matter how complex or unusual. Our world-wide organization, with plants and subsidiary companies in many countries, makes this superior service available to you anywhere.

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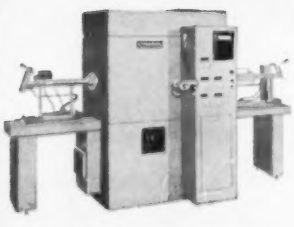
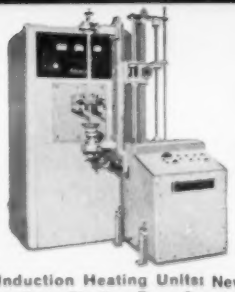
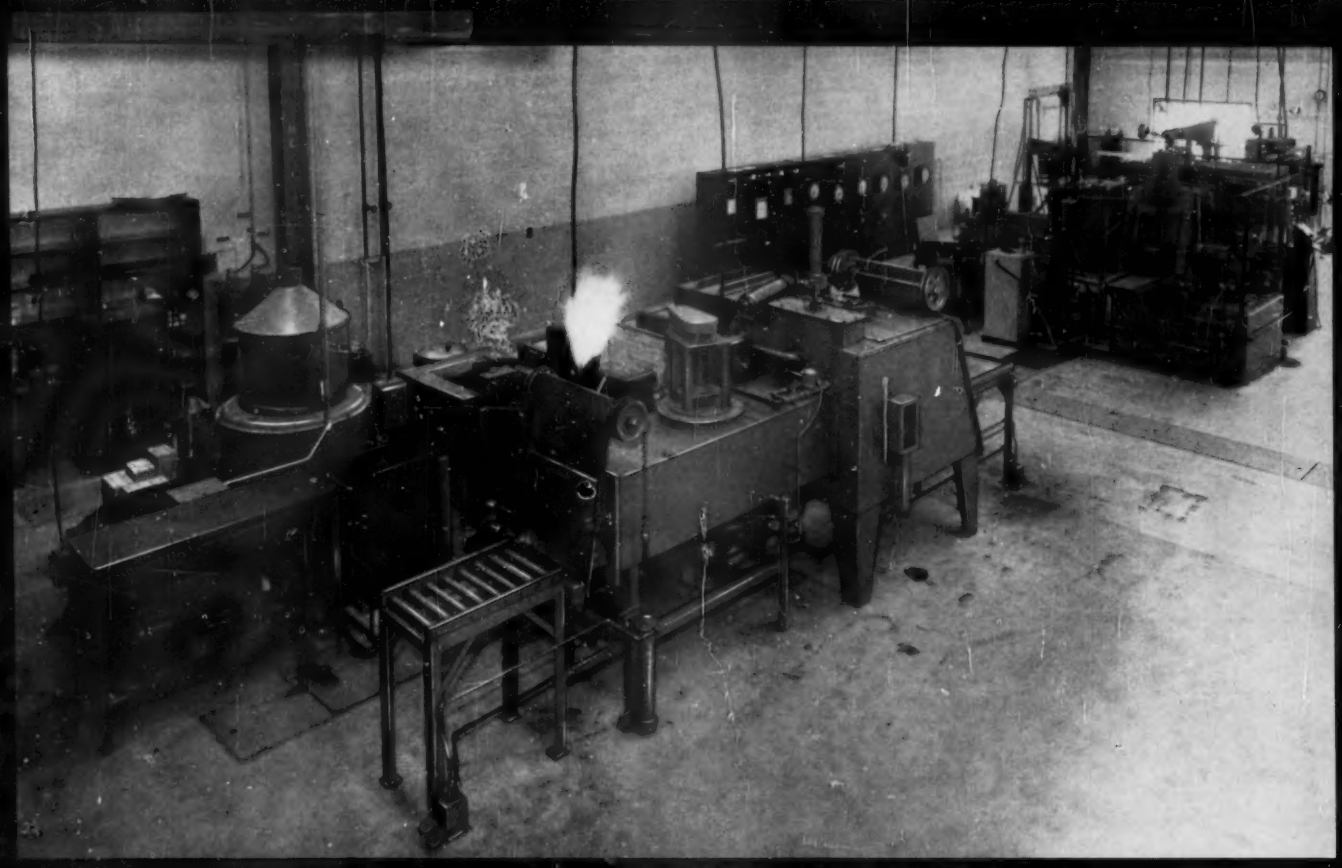


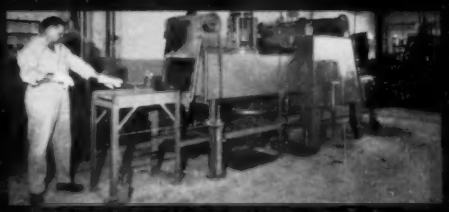
High Temperature Furnaces: New Graphite Tube Furnace (shown) with temperature range 2600° F. to 5000° F. for research and production in metal and ceramic fields.



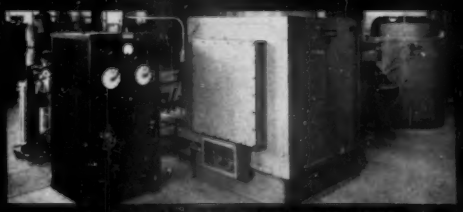
Induction Heating Units: New Lindberg Floating Zone Scanner for precise production of hyperpure semi-conductor materials and metals and Induction Heating Unit (shown).



General view of complete Heat Treating Department at new plant of Lear, Inc., Grand Rapids, Michigan. All equipment including furnaces, Hyen atmosphere generator, control panels, oil quench is by Lindberg.

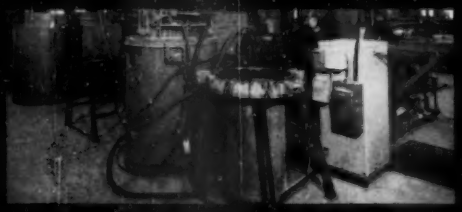


Electric atmosphere brazing and annealing furnace. Hand pusher type . . . 2100° F. maximum temperature.



Electric pit furnace for treatment of high temperature alloys in dry hydrogen atmosphere. Tap transformer also shown.

The retort for high temperature pit furnace for treatment of alloys at 2200° F. (left). Production tempering furnace, 22" x 26" work space, shown at right.

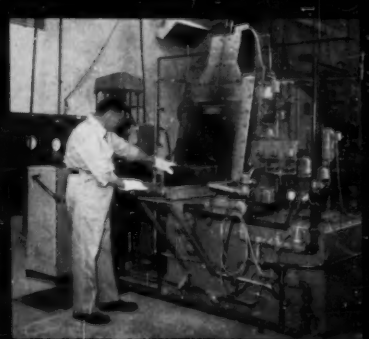


Atmosphere tempering furnace, 16" x 24" work space, for both gaseous nitriding and steam treating. One retort in foreground.

LINDBERG Equips Complete Heat Treating Department at Lear, Inc.

The heat treating requirements for the new Grand Rapids plant of Lear, Inc., were put into Lindberg's hands. We supplied them in the way the photographs show. Our engineers cooperated fully with Lear in the selection of the proper Lindberg equipment and the layout of the complete heat treating department. This installation illustrates one of the big advantages of consulting with Lindberg. Our years of experience in all phases of the application of heat to industry, our complete line of all types of industrial heating equipment offer the best assurance that you can coordinate all your needs in one reliable, experienced source. Consult your local Lindberg Field Representative (see classified phone book) or write us direct.

LINDBERG **heat for industry**



Integral quench furnace with CORRTHERM® electric heating elements . . . for carbonitriding and general heat treating.

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The men who control your precision standards will quickly see the wide utility, rugged durability and work-speeding, accuracy-promoting features of Starrett No. 653 Dial Comparator.

The substantial, solidly ribbed, precision ground, 8″ x 9″ base platen will accommodate almost any part with plenty of room for V-blocks or special fixtures. The rigid, precision ground, 1½″ dia. column gives 9¼″ vertical capacity; strongly ribbed indicator bracket provides 5″ throat depth.

Adjustment is simple and *positive* with fine vertical adjustment to bring the indicator to final setting quickly and accurately. Indicator with 2¼″ dial and lever control is graduated .001″, reads 0-50-0, range .250″. Other indicators can be furnished.

Starrett No. 653 is typical of a complete line of dial indicators and dial gages that will help you produce better work through positive precision. Your nearby Industrial Supply Distributor has them. Call him for quality products, dependable service . . . or write for complete Starrett catalog. Address Dept. E, The L. S. Starrett Company, Athol, Mass., U. S. A.

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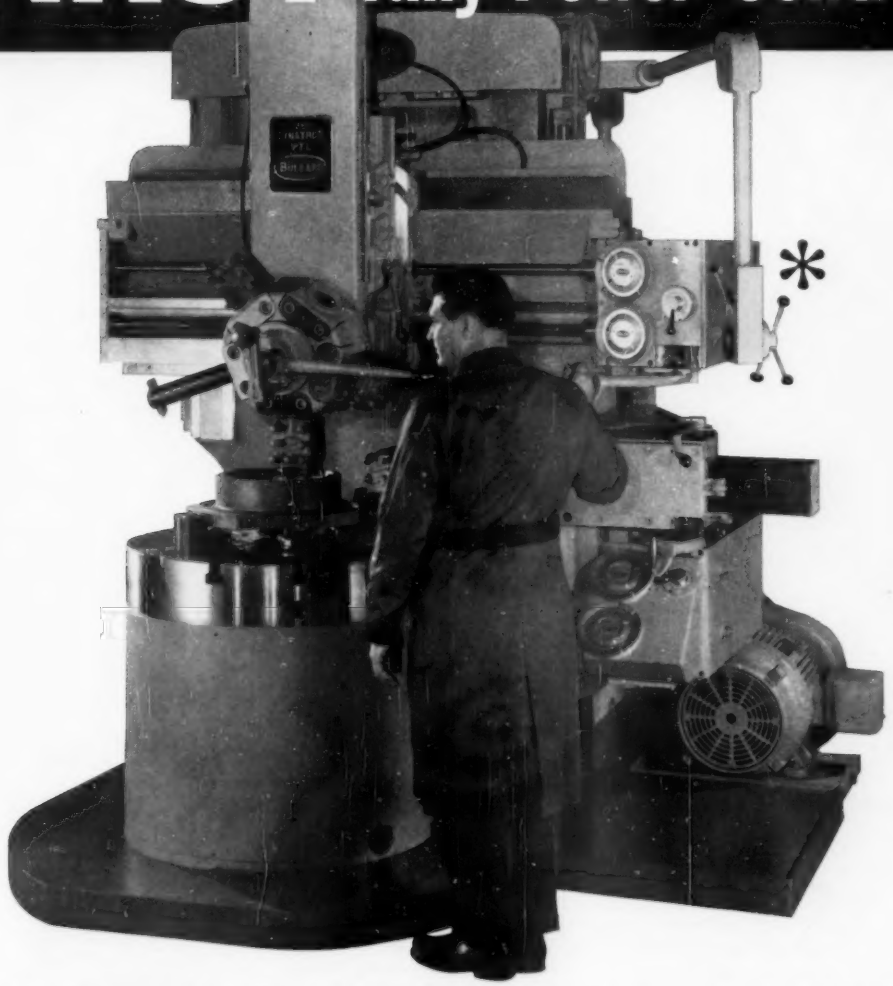
NOW Bullard DYNATROL*
FIRST fully Power-Controlled V.T.L.



Dynatrol* V.T.L. has Bullard's new Dynamic Precision Control . . . a fully powered machine tool control system which pays off in greater production.

Dynamic Precision Control keeps the tool in the cut more of the time . . . cuts time between cuts . . . increases the operating speed and output of the machine.

Dynatrol provides **infinitely variable feed rates** throughout the full range and **variable traverse rates** from zero to nine feet per minute. Feed rates may be advanced or retarded while the machine is cutting to obtain maximum tool performance and productivity.

Nine sizes from 26" to 124" table diameter.

Send to The Bullard Company, Bridgeport 9, Connecticut, for detailed catalog. Telephone EDison 6-2511.

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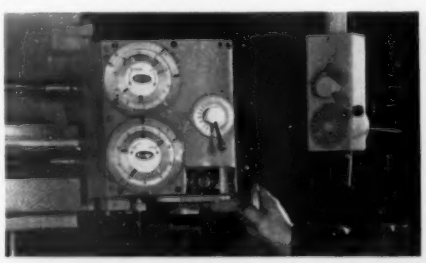
The control center of the New Bullard Dynatrol V.T.L. provides single lever control for all motions of each head. Feed rates — infinitely variable from zero to maximum — are directly geared to table rpm. A simple pendant controls start, stop and speed of table. Equally simple remote controls are available for machines of all sizes.



High-Spot Features of the DYNATROL® V.T.L.

Dynatrol V.T.L. is POWER CONTROLLED

By lever or pendant — it's your choice — head traverse rates can be varied from zero to nine feet per minute. Easy-to-read dials show exact position.

Feed selector gives infinitely variable feed rate without interrupting the cut.

Dynatrol V.T.L. is VERSATILE

Available equipment includes:

Bullard variable speed drive for infinitely variable table speeds throughout the full range with no loss of usable horsepower.

Fully automatic operation by Bullard Man-Au-Trol or point-to-point or continuous path numerical control systems.

Unique Size-Au-Trol* for accurate positioning of all heads. Contouring attachments: Hydraulic, electronic or electro-hydraulic. Four- or five-sided power-indexing turret heads. Thread cutting, drum scoring and angle turning attachment. Power-operated chucks.

Dynatrol V.T.L. is COMPACT

The new Bullard Dynatrol V.T.L. is compact in design, rigid in construction, lower in height, reduced in floor area.

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Automatic lubrication throughout... fewer parts... fewer adjustments... easily accessible.

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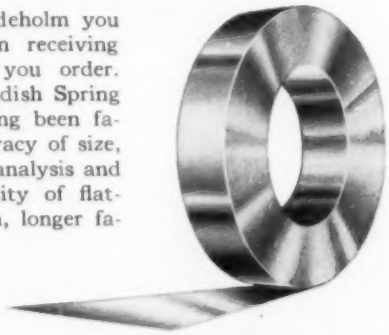

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MASTERLINE GISHOLT SINCE 1887

How would you thread parts like this?  ***By milling? By grinding?***

WATERVLIET THREADS 342% FASTER WITH CRI-DAN

Uses low-cost carbide tools in place of expensive milling cutters and grinding wheels

If you are threading small or medium parts up to 50 Rc hardness, these production figures comparing thread milling and grinding with the Cri-Dan method may be mighty impressive to you:

Breechblock threading production increased from 14 to 48 pieces per day.

Bushing threading production increased from 80-95 to 320 pieces per day.

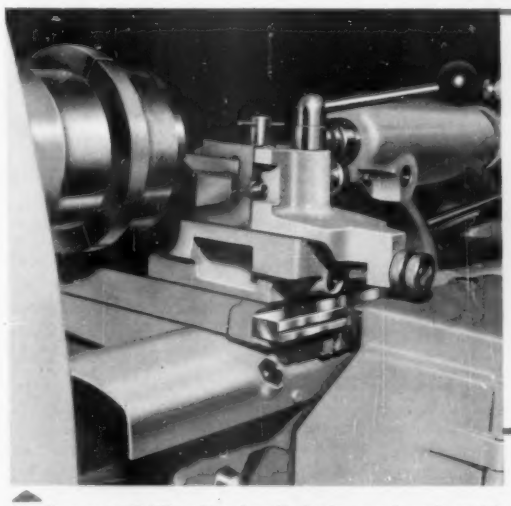
These increases are typical of many now obtained on Cri-Dan Threading Lathes by Watervliet Arsenal, Watervliet, New York.

But production alone is not the full story. Cri-Dan improves quality—gives a smoother finish without scallops or chatter marks. Cri-Dan cuts tooling costs by using inexpensive, single-point carbide tools that are easily sharpened or replaced. Setup on these jobs averages just 15 minutes. Automatic cycle often permits one man to handle two machines with ease.

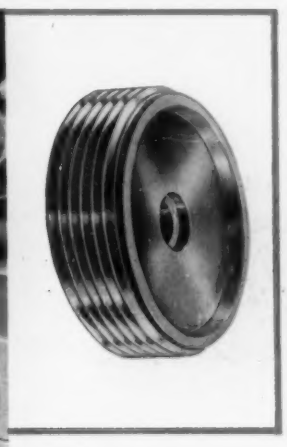
Cri-Dan method simplifies setups, cuts tool and original equipment costs, speeds production. Higher metal removal rates of carbide tools obsolete thread milling and grinding on tough jobs and materials.

Producing four acme threads per inch on this 1″ bushing demonstrates the efficiency of the Cri-Dan B on small parts. Stock, 1120 or 1130 steel; major diameter, 0.832″; pitch diameter, 0.737″. Thread depth, 0.080″. Thread milling production, 80-95 parts per day at 5-6 minutes per part. Cri-Dan production rate, 320 parts per day at 1.5 min. per part. Carbide tool life on the Cri-Dan averages 200 parts.

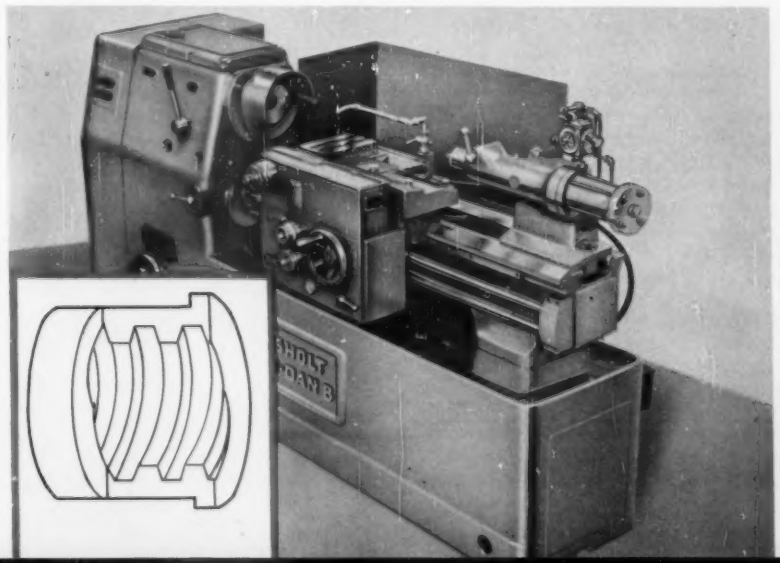
For new Cri-Dan B Catalog, circle No. 701 on Reader Service Card.



Tooling on a Cri-Dan E to handle larger work such as this 8″-diameter breechblock bushing. Standard 8-pitch thread is produced in 35-41 Rc material at a rate of 48 pieces daily, as compared to 13 parts per day by thread grinding.



Cri-Dan E production rate for 6″-diameter breechblocks, 48 pieces each day, compared to 14 pieces per day by thread grinding shows an increase of 342%.



THIOKOL CHEMICAL CORP., REACTION MOTORS DIV., SAVES 75% ON TOUGH ROCKET ENGINE PART

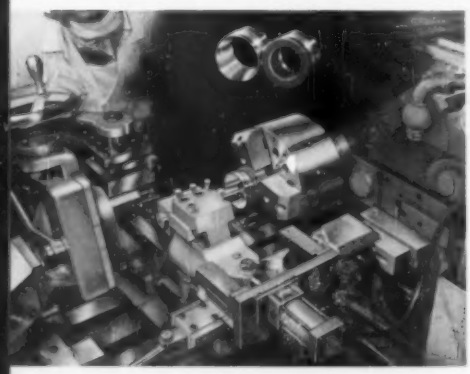
Quick setup and versatility of No. 3 ram cut job-lot costs

One or more of the three problems listed below probably needs answering in your shop, too.

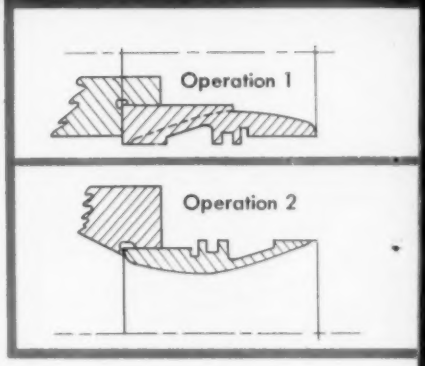
Finish to 32 micro-inches RMS. Contour to plus 2″, minus 0″. Machine and tooling versatility to handle other jobs to close tolerances, with minimum change-over time and tooling.

Here's how these problems were answered for Thiokol Chemical Corp's. Reaction Motors Division plant, Bristol, Pennsylvania. The machine: a standard Gisholt MASTERLINE No. 3 Ram Type Turret Lathe. Tooling: standard turret lathe tools; a 10″, 3-jaw air chuck; and a special taper attachment.

The part, a copper nozzle for a liquid fuel rocket engine, is completed in two operations. It is held in the bore, locating against the back face. Hexagon turret tools turn straight O.D. surfaces, while square turret tools machine O.D. contours and grooves, and face the end. One half of the bore is rough- and semi-finished in four passes with the rear tool-post, using a taper attachment to generate the contour, F.t.f. time, 12 min. For operation 2, the work is held on the machined O.D., locating against a machined face. Hexagon turret tools finish-turn the O.D. The end is faced from the square turret. The second half of the bore is roughed, and semi-finished in four passes. The entire bore is then finish-generated, using the special taper attachment. Time, 8.5 min., f.t.f.



Special rear tool-post taper attachment generates contour in bore. Air cylinder maintains constant pressure on cam follower for 32 micro-inches RMS finish. (Inset) Finished part at left, first operation at right.



Change-over from operation 1 to 2: new chuck jaws, resetting of tools on hex 5 and taper attachment. Versatility? Nine operations on five different complex parts are performed on this machine, using the same hex turret tooling with only minor tool adjustment or replacement and chuck jaw changes.

Standard machine with minimum special tooling keeps costs down on short runs of complex parts. Accuracy and finish in contoured bore obtained with special cam and taper attachment.

For information on Ram Type Turret Lathes, circle No. 702 on Reader Service Card.

BALANCING AT CATERPILLAR RESEARCH HELPS DESIGN AND PRODUCTION

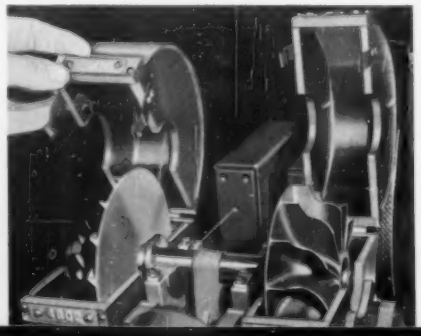
With the trend to smaller, lighter components and higher operating speeds, balancing is an important tool in product development—as well as in production. But to justify its purchase for balancing small research lots, a machine must have the versatility to handle a great range of work sizes and weights. This setup, showing how balancing is used in development work, may give you some new ideas for your own operations.

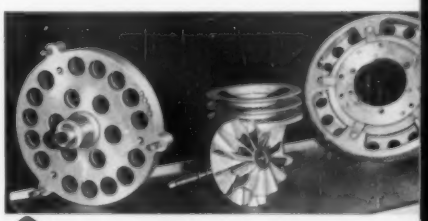
31S balancer handles wide variety of test parts . . . boosts designing and production planning efficiency

High-speed components were causing vibration problems in the Research Department of Caterpillar Tractor, Peoria, Illinois. Since existing equipment was not capable of solving this problem, a Gisholt 31S Balancer was installed. The 31S was selected for its ability to meet the necessary accuracy requirements—for its versatility in handling a wide range of work economically...and for its fast setup to handle 1- or 2-piece lots.

Because Gisholt balancers use modern, electrical methods to measure amount and indicate angle of unbalance in each correction plane, maximum accuracy is assured and guesswork is eliminated. Two sets of work supports permit balancing of work ranging from 2 to 300 lbs., up to 24″ in length and diameter, with shaft diameters at bearing surfaces up to 2⅛″ or 5″. Setup averages approximately 30 minutes for most parts handled.

A typical job—a Turbo-Supercharger for a 6-cylinder diesel engine: diameter, 6″; bearing shaft, ¾″; weight, 4 lbs.; operating speed, 50,000 r.p.m. This requires 2-plane balancing with correction on the large-diameter wheels at each end. Unbalance is quickly measured and located. Correction is by grinding. Since this is a test piece, time is not too important, but accuracy is vital. Balancing reduces vibration at bearing surfaces to .000025″ or less.

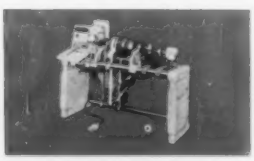




Typical parts handled efficiently in 1- and 2-piece lots. Left to right: fixture for a high-speed coupling which has no bore for shaft support; turbine wheel and shaft; fan pulley; timing gear assembly.

Accurate balancing of prototypes in research permits early decision as to where metal may be removed or added before going into production—saves costly production tie ups—eliminates extra design changes.

For information on Type S Balancers, circle No. 703 on Reader Service Card.



HOW THOMPSON RAMO WOOLDRIDGE INC'S. FEDERAL WORKS SIMPLIFIES GROOVING JOB ON TRANSMISSION PART

Smart tooling speeds machining, automatic cycle doubles operator productivity

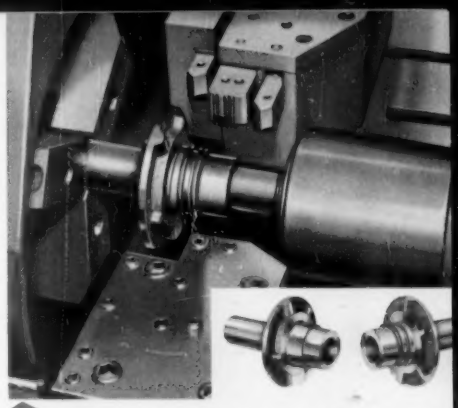
In this setup on two Gisholt MASTERLINE No. 12 Automatic Chucking Lathes, tooling is simple and floor-to-floor time is fast. It shows how a simple tooling change cut costs and machine downtime for Federal Works, Thompson Ramo Wooldridge, Inc., Detroit, Michigan.

The workpiece, a transmission converter support assembly, is held in a 12", 3-jaw compensating chuck. It is supported between centers for extra rigidity during simultaneous turning and grooving cuts.

The front carriage moves towards center, then feeds towards the spindle. Tools turn three diameters, including the large flange O.D., then move back for tool relief. At the same time, the rear independent slide feeds towards center to form four grooves, chamfer the large flange O.D. edge and the tailstock end of the part. F.t.f. time, just 30 seconds.

Grooving tooling is worth noting. Previously, expensive circular form tools were used. When one cutting edge dulled or broke down, the entire tool had to be replaced or discarded. Now, four separate throw-away inserts are used in a special holder. Approximately 400 parts are produced per cutting edge. When one edge dulls, the insert is quickly reversed, minimizing downtime.

Quick, accurate chucking and automatic cycle permit one operator to handle two identically tooled No. 12s. Throw-away inserts replace expensive form tools—mini-



Work is supported between centers and held in chuck for maximum rigidity during simultaneous turning and grooving. Four throw-away inserts in grooving tool holder are quickly reversed or replaced, permitting more parts per day at less cost.

For complete information on the Gisholt MASTERLINE No. 12, circle No. 704 on inquiry card.

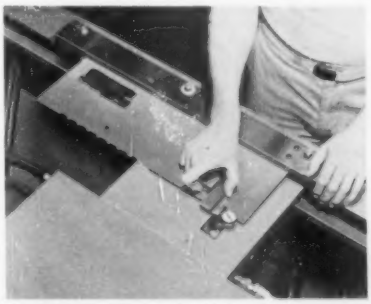
CROSS FEEDING TURRET JETRACER CUTS TOOL COSTS, SAVES TIME

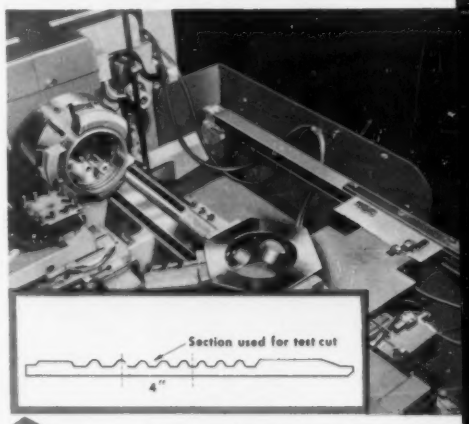
JETracer eliminates costly form tools. Extra cross feed travel minimizes tooling

The flexibility made possible with this tooling setup on a Gisholt MASTERLINE 3L Saddle Type Turret Lathe may give you some new ideas. An oil well component manufacturer is using it to save time and tooling costs on a wide variety of jobs. Work includes straight and taper boring and threading, and contour machining in addition to conventional turret lathe assignments.

The basic tooling to handle the range and type of work described, is as follows: cross feeding hexagon turret with JETracer control and cross travel of 6" to rear of center and 9" to front of center allowing one boring bar to handle a diameter variation of 12"; dial indicators to speed setup for both motions of the hex turret; a compound cross slide, with power angular feed and a quick indexing tool post plus a taper and a chasing attachment for internal and external threading operations.

Here's how the tooling works on a typical job, a centrifugally cast steel cement coupling collar, 21¾" long, 14⅜" diameter. The work is held in a 21" 3-jaw scroll chuck. Wide swivel jaws minimize distortion. The end is faced from the square turret. The work is turned and bored from the hex turret. The grooves in the bore (previously handled by form tools) are then rough- and finish-traced from the JETracer controlled cross feeding hex turret. The front end of the bore is threaded for a depth of 5" from the compound cross slide to complete the operation. Rough casting weight is reduced almost 50% and required accuracy and finish are easily met in a f.t.f. time of only 105 minutes.



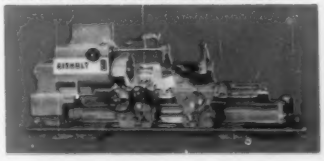


JETracer controlled cross feeding hexagon turret eliminates costly form tools, reduces downtime, tool maintenance costs and eliminates human element in spacing of grooves in bores of cement coupling collars. (Inset) Drawing shows part and 4" section used for test cut shown in photo.

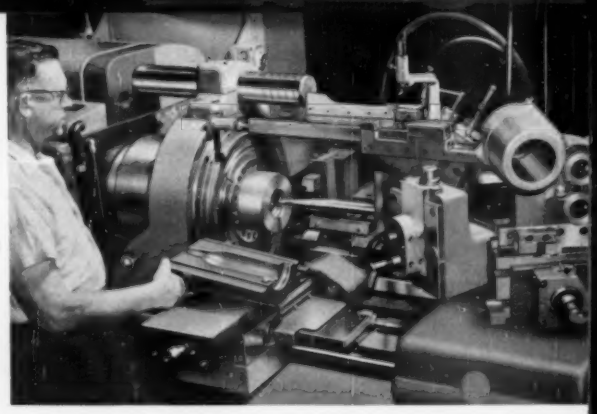
Stop block, attached to template and gage block, is used with dial indicator to establish exact relationship between JETracer stylus and cutting tool with relation to each other and to work.

Capacity of Gisholt 3L plus JETracer, compound slide, taper and chasing attachments permit handling wide range of work economically. Tracing eliminates expensive form tools. Extra cross travel of hex turret minimizes changeover and tooling costs.

For information on Saddle Type Turret Lathes, circle No. 705 on Reader Service Card.



OVERMYER MOULD MACHINES COMPLEX BORES 250% FASTER—AUTOMATICALLY



JETracer slide tool mounts on any turret face...does not interfere with other turret stations. Simple, inexpensive setup handles difficult bottle-mould contours in a single pass...holds .002" tolerance in bores up to 6½" in diameter, up to 12" deep.

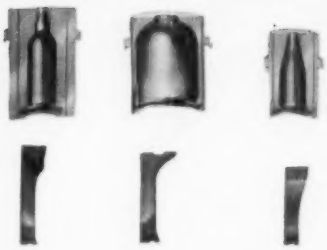
Simple turret-mounted JETracer slide tool plus automatic cycle speeds machining, improves accuracy and finish

With the setup shown here, you don't need expensive form tools, cams or complex setups to produce difficult contours—for example, the bores of the bottle moulds shown at right. All they use for jobs such as these at Overmyer Mould Company, Winchester, Indiana, is a simple JETracer slide, mounted on the turret of a Gisholt 2F FASTERMATIC Automatic Chucking Turret Lathe. A simple setup, yet it allows Overmyer to handle a great variety of complex shapes and sizes—from 12-oz. bottles to gallon containers—small lots to large.

On the 12-oz. wine bottle mould setup shown, Overmyer saves 250% in setup and production time, and cuts tooling costs substantially. And the finish they get (45 micro-inches RMS) reduces polishing 70%!

The mould, in two mating sections, is held in a special, parallel closing-type collet chuck. A steady rest supports the outer end. The mould is faced to size and an O.D. radius is formed from the rear cross slide. The bore is roughed from the hex turret. Turret slide tools operated by a pusher on the rear cross slide groove and form a 20° angle on the plug seat area. The JETracer slide tool completes the internal contour. Reverse JETracer feed cleans up to the desired accuracy and finish. F.t.f. times range from 20 minutes on this job to 25 minutes for the gallon-jug moulds.

Typical bottle moulds and templates showing complex contours and fine finish obtained with automatic JETracing as part of automatic machine cycle.



Automatic JETracing allowed by flexible FASTERMATIC handles complex contours... eliminates expensive cams and form tools... speeds production...boosts quality.

For Fastermatic Catalog, circle No. 706 on Reader Service Card.

BUICK DIV. OF GMC SUPERFINISHES TO IMPROVE QUALITY

Process minimizes wear, provides wide range of "controlled" surface finishes at minimum cost

Want to stop paying premium prices for low micro-inch surface finishes and obtain improved quality and longer service life as well? Then investigate Superfinish—the low-cost way to get any "controlled" surface finish on job lots or production runs.

This process proves itself every day in plants all over the world—for example, at Buick Division of General Motors Corporation, Flint, Michigan, Here 45 Superfinishers are used on more than 55 different parts for Buick's twin-turbine automatic transmission, and on other automotive parts as well.

"Controlled" finishes ranging from 2 to 51 micro-inches RMS are produced on external, internal, round, flat, solid and interrupted surfaces. The operator simply loads, starts the automatic cycle, and unloads. Stone pressure, grade, reciprocation rate and spindle speed are preselected to produce the desired finish on each job—automatically, piece after piece.

In most cases work is rough-ground, then Superfinished, eliminating finish-grinding. On some jobs all grinding is eliminated, as on the pump face of the flange-and-bushing assembly for converter reaction shafts, shown.

Superfinishing directly from machined surface eliminates intermediate grinding...provides desired surface finish of 8 micro-inches RMS in minimum time, at less cost. Process is easily applied to all types of surfaces for comparable savings.

The interrupted pump face surfaces on flange-and-bushing assemblies for converter reaction shafts are Superfinished on this Model 81 single-spindle vertical Superfinisher. Cup-shaped stone removes up to 0.001" stock left after finish-facing in 32-second finishing cycle and maintains flatness within 0.0002" while producing an 8 micro-inch RMS surface finish.

An 8-page reprint covering other setups at Buick Division of General Motors Corporation, will be sent on request. Circle No. 707 on Reader Service Card.

No. 1-260
755

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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Madison 10, Wisconsin

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Available in sizes 10, 15, 20.

Screw-On Type. Available in sizes 3, 5, 7, 10.

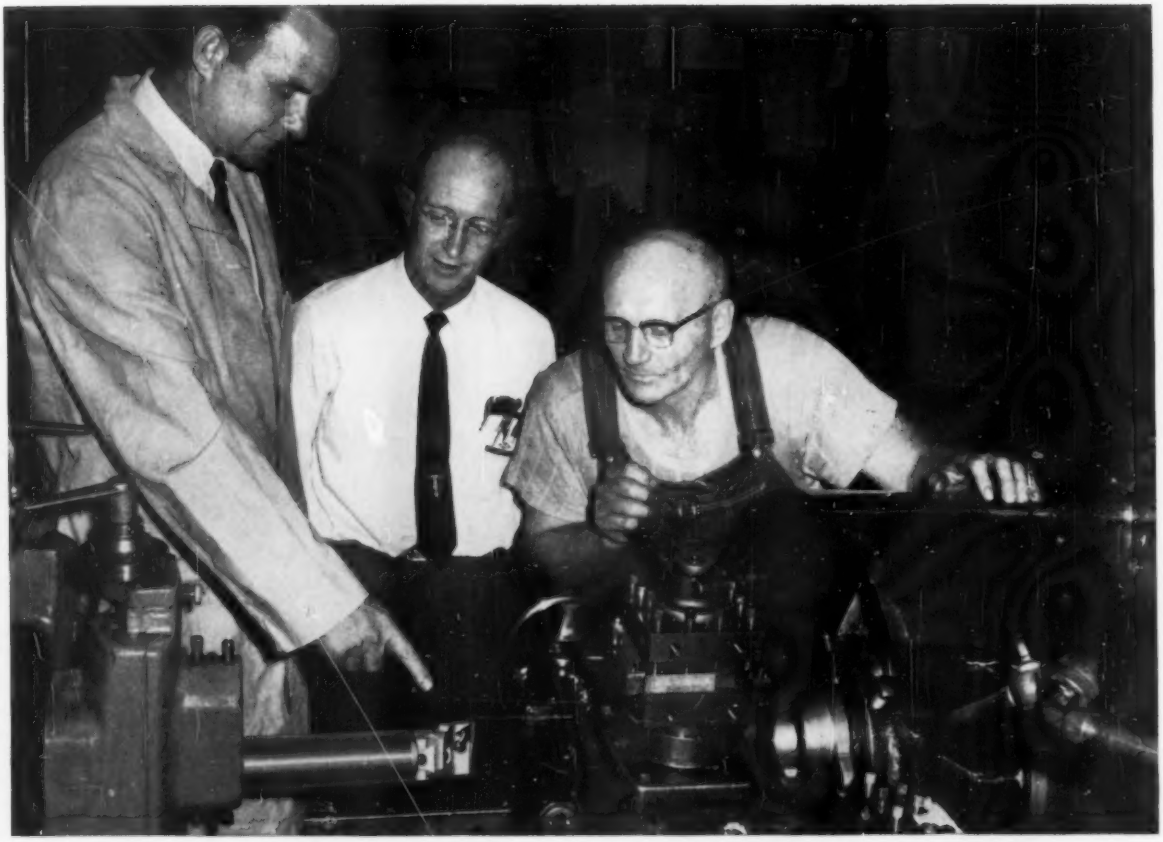
Accuracy! Economy! You get the best of both. Microbore, the single point cutting tool with Micrometer vernier adjustment becomes the tool holder—rigid, adjustable to precise accuracies in seconds. Kendex mechanically held throw-away inserts do the cutting. Triangular shaped, the inserts can be indexed from tip to tip. When expended, the insert is thrown away. Replacement is simple, costs far less than re-grinding. Inserts are held in place by *screw-on button* or *clamp* for fast indexing or removal. Available in sizes 3, 5, 7, 10, 15 and 20. Write for complete information on Microbore tooling with Kendex throw-away inserts, the latest development in Microbore—the complete tooling system.

DeVlieg Microbore® System

DEVLIEG MICROBORE • DIVISION OF DEVLIEG MACHINE COMPANY

Fair Street • Royal Oak, Michigan

USE READER SERVICE CARD, CIRCLE 13



Kennametal Carbide Engineer, Tool Engineer and Machine Operator. This 3-Man Tooling Team found the answer to better boring operations at Gardner-Denver Company.

This Adjustable Head KENNAMETAL K-Bar does the work of 5 "special" bars

Three bores on this 8620 steel casting chuck end previously required five special boring bars. Chatter and inability to hold size was a constant problem. Then the Kennametal Carbide Engineer suggested that one Kennametal K-Bar be tried for all three bores.

Although the test setup was not ideal (11-inch bar overhang), the K-Bar conclusively outperformed the five bars previously used. Increased machining speeds possible with the K-Bar produced the outstanding time reduction shown in the table. Substantial savings will also accrue through reduced tool maintenance.

In the tests, depths of cuts were varied from .001 to .500 but chatter could not be detected. The high rigidity of Kennametal (three times that of the hardest steel) made it possible to eliminate weaving, chatter and provided a better finish. Ask your Kennametal Representative, or write us direct about our line of adjustable K-Bars with Standard Kendex inserts and chip breakers, seven sizes, 1-inch to 2½-inch diameters. KENNAMETAL INC., Latrobe, Pa.

Material: 8620 steel casting

3-bore operation:
4.470 bore—.325 depth of cut
3.720 bore—.290 depth of cut
3.220 bore—.290 depth of cut

Actual machining time:

Original setup (5 special bars)	16.7 minutes
Kennametal K-Bar	3.1 minutes
TIME SAVED PER PIECE	13.6 minutes

Kennametal K-Bars PREVENT chatter, taper, weaving and drag-out scoring. Kennametal K-Bars PERMIT successful use of harder grades of carbide inserts, faster machining speeds. 07286

INDUSTRY AND
KENNAMETAL
...Partners in Progress

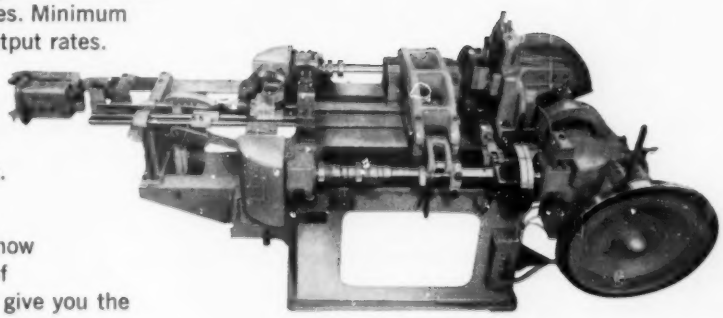
U.S. MULTI-SLIDES® BUILD PROFITS... *PIECE-BY-PIECE*

Hour after hour, day after day, U. S. Multi-Slides are producing perfect pieces like these — by the hundreds of thousands. A single cycle of the machine produces a FINISHED formed stamping. Secondary operations and expensive handlings are eliminated.

Multi-Slide production is consistently accurate even on complicated shapes and assemblies. Minimum inspection rejects result in higher output rates.

Unless you are now using U. S. Multi-Slides, you can't be sure your present method of stamping isn't chipping away at your profits.

To be certain, send us samples and "specs" of the stampings you are now making, or submit specifications of projects you are considering. Let us give you the facts of "piece-by-piece" profit through advanced U. S. Multi-Slide methods . . . you will be under no obligation.



U. S. Multi-Slide #33

Write today for Bulletin 15-T.

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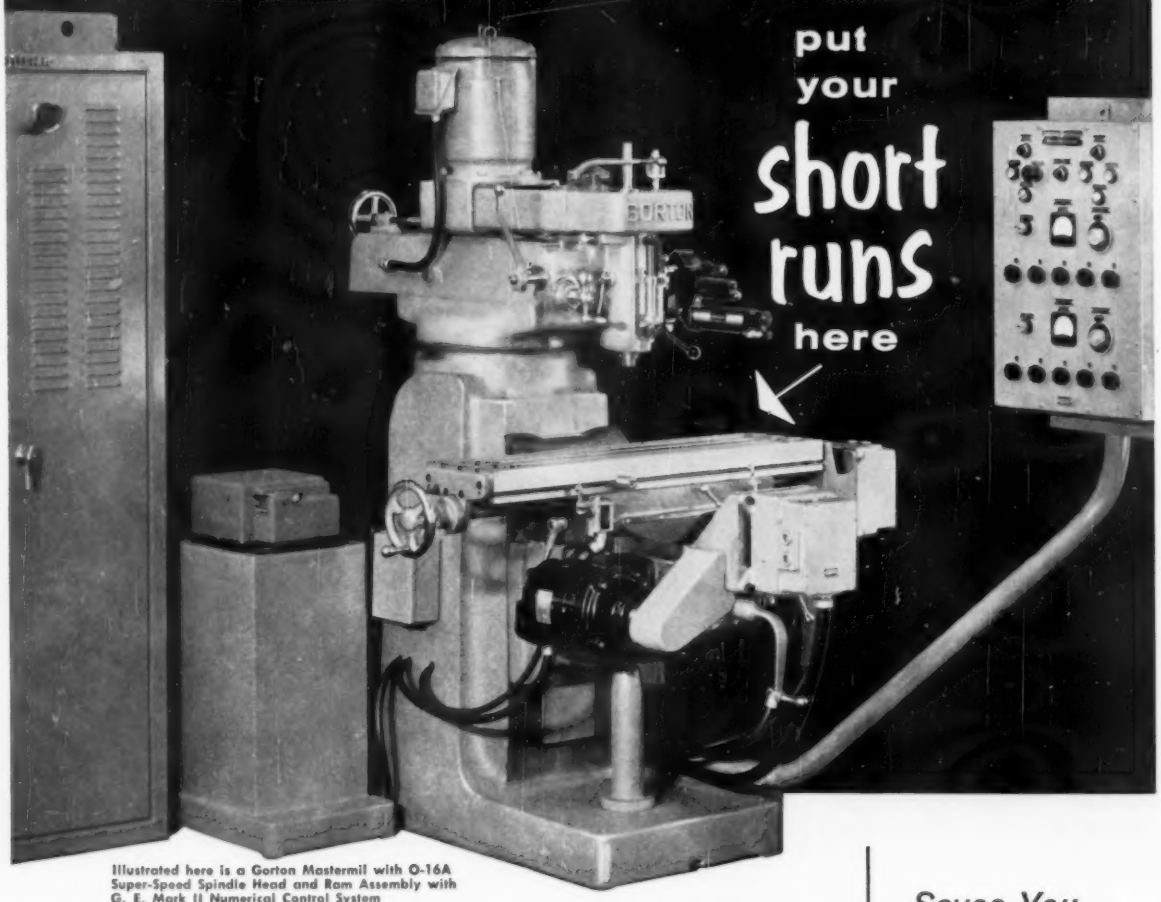
AMPERE (East Orange) NEW JERSEY

U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories

FOR NUMERICAL CONTROL AT LOWEST COST



Illustrated here is a Gorton Mastermil with O-16A Super-Speed Spindle Head and Ram Assembly with G. E. Mark II Numerical Control System

GORTON NUMERICAL CONTROL

is field tested and proved in use

This is how Gorton Numerical Control saves you money on short runs:

- — eliminates elaborate and costly tools, dies, jigs and fixtures
- — wastes no time because operator does not "pace" the work
- — makes no mistakes because operator skill not required
- — extreme, repetitive accuracy is easy and automatic
- — change overs in set-ups can be made quickly
- — signals operator when tool changes are needed
- — guides cutter in close quarters without damage to work or cutter
- — making punched tape is simple typewriter operation

Punched tape . . . or magnetic tape control . . . is available to you on SIX standard Gorton machines and also on Gorton custom-designed machines. You'll be agreeably surprised when you learn the low cost of Gorton Numerical Control and how much more it gives you for your money. For full information write

Saves You Money on —

- face milling
- side milling
- end milling
- straight line cavity milling
- slotting
- drilling
- reaming and boring

Your letterhead inquiry will receive prompt attention.

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Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

WHY CHAMFER

prior to tapping?

Why? Because clean, concentric chamfered holes speed tapping operations, increase tap life and accuracy, eliminate breakage, burring or flaking and lower both drilling, tapping and scrap costs.

Therefore, you are time, tools and dollars ahead when you drill and chamfer simultaneously with Mohawk Standard Subland drills.

How? Mohawk "Standards" are faster, more accurate—eliminate jig and fixture movements—increase tool life, reduce scrapped parts and save man hours too! Mohawk Standard Sublands outlast ordinary tools and remain accurate through regrinds—right down to the shank.

Better yet . . . All Mohawk "Standards" are *immediately* available from your local distributor's stock. Call your Mohawk man and start your savings program today!

comparison chart

Drilling and Chamfer methods prior to Tapping

	Standard Mohawk Subland Drill	Step Drill	Separate Operations 2 Drills	Drill Operation Only No Chamfer
Chamfer Concentricity	Excellent	Excellent	Poor	Zero
Hole Location	Excellent	Good	Fair	Fair
Drill Hole Size	Excellent	Poor	Fair	Fair
Pieces Per Grind	Excellent	Fair	Excellent	Excellent
Burrs (None)	Excellent	Good	Fair	Zero
Tap Life	Excellent	Good	Fair	Poor
Regrind	Excellent	Poor	Excellent	Excellent
Local Stock	Excellent	Good	Excellent	Excellent

Remember **. . . Mohawk Standard Sublands are on your distributor's shelves—all practical standard sizes, step lengths and shanks.**

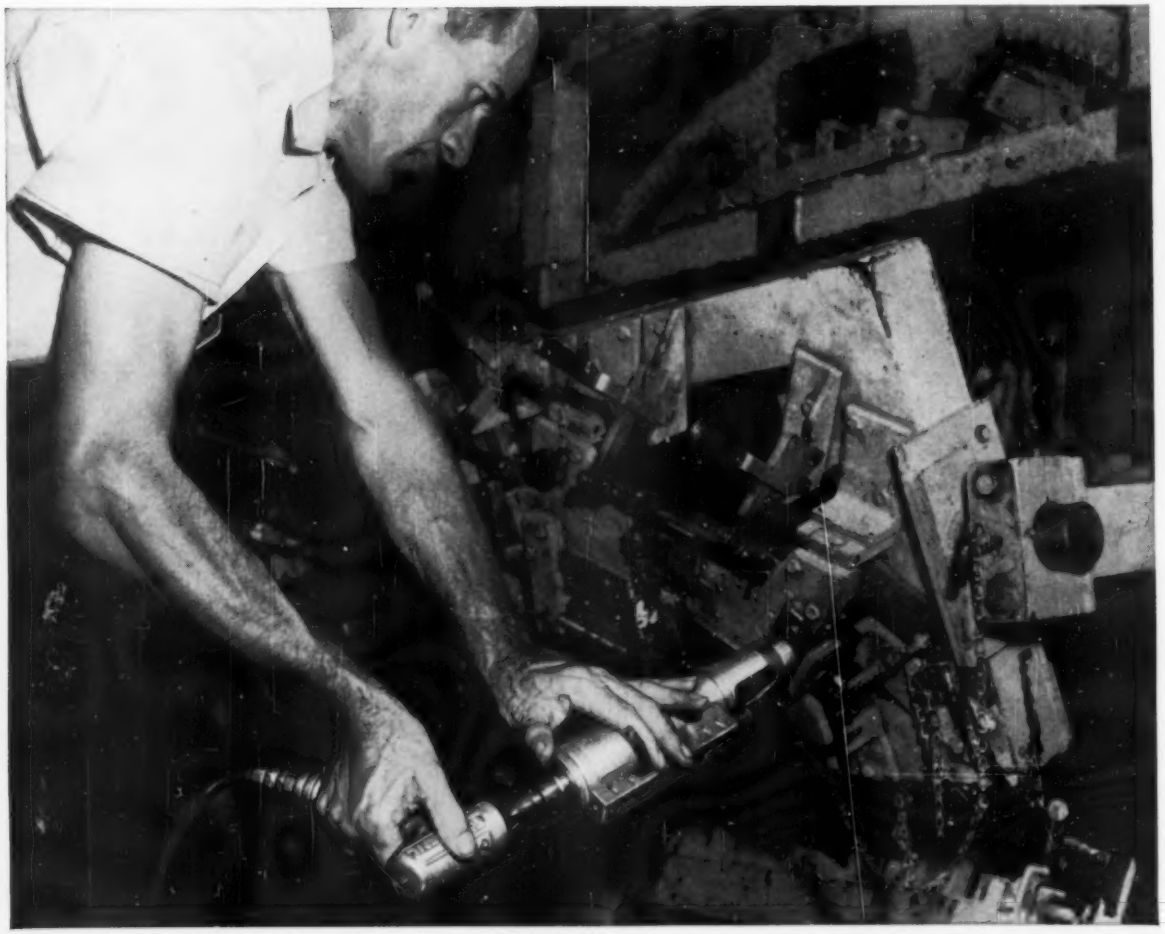
Ask For Your Copy Today!

This new 12-page catalog that illustrates the multiple advantages of drilling and chamfering (prior to tapping) is yours for the asking. Lists all practical sizes, types and suggests simplified method for determining your requirements.

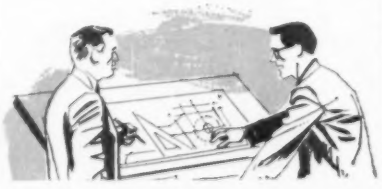
worlds largest producer of Sublands

Mohawk TOOLS, Inc.

Montpelier, Ohio



Now drill holes accurately, easily in hardest metals with Gardner-Denver K-MATIC®



IN INDUSTRY — SPEEDING THE PACE, the Gardner-Denver specialist is an integral part of the team. He works side by side with engineers and designers, helping to solve their problems, for at Gardner-Denver there's no substitute for men—our 100-year philosophy of growth.

Here's a production-line air-powered drilling unit that is only 16" long, weighs 7½ lb.—yet develops 1000-lb. thrust for drilling in even hardest metals. It's the Gardner-Denver "K-Matic."

It brings a fine degree of hole quality to production drilling, plus production short cuts—the "K-Matic" drills holes so clean and true that reaming is often unnecessary.

The "K-Matic" is an automatic precision drilling machine—adaptable for use in stationary applications or as a portable drill. It has positive feed, rated capacity to ⅜", and is easily mounted in any position.

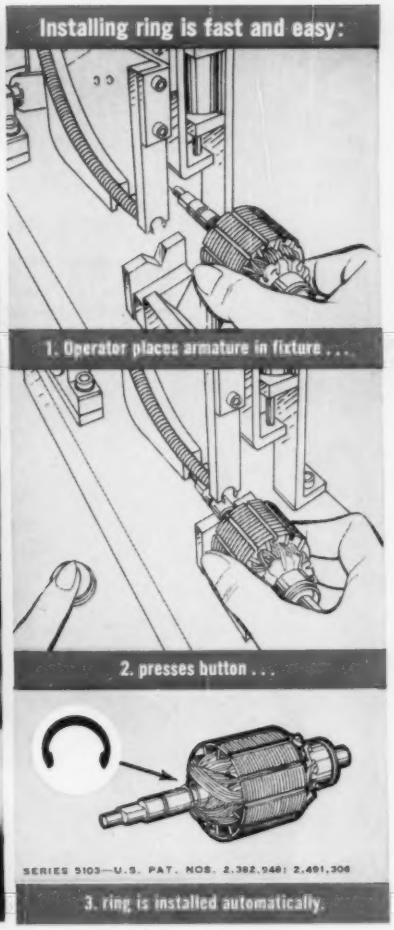
For complete information, contact your Gardner-Denver representative or write for Bulletin 94-1.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario



Mechanized Truarc ring installation speeds assembly

eliminates costly shimming and gauging operations

Fast, semi-automatic assembly and the elimination of costly production operations are among the benefits Leece-Neville Co., Cleveland, Ohio, derives from the use of Truarc retaining rings in the manufacture of its fractional horsepower automotive motors.

Radially-assembled Truarc Series 5103 Crescent® rings—supplied pre-stacked—are used to position and lock the armature in the motor housing. Using the special Truarc pneumatic applicator-dispenser illustrated above, the operator merely inserts the rotor and presses a release button. The ring is installed automatically in a pre-cut groove on the rotor shaft!

The precision manufactured Truarc rings, seated in accurately located grooves, reduce accumulated tolerances from a possible maximum of .184" to .025". Costly, time-consuming shimming operations previously necessary to take up end play are eliminated, together with as many as four gauging operations required to select and place the shims.

The Leece-Neville story is just one example of the way Truarc retaining rings are stepping up production on today's fast-moving assembly lines. These versatile fastening devices simplify design, speed assembly and eliminate rejects. In replacing conventional fasteners, they often improve product performance and reliability. All of these advantages are in addition to substantial cost savings!

Truarc retaining rings come in 50 functionally different types . . . up to 97 different sizes within a type . . . 6 metal specifications and 13 finishes. Special Truarc hand, magazine and automatic applicators and grooving tools make production-line application easy on virtually every type of product. Make sure you have on file the new 16-page Truarc assembly-tool catalog No. AT 10-58. Write for your copy today. And remember Waldes Truarc engineers are always ready to assist you with your special production problems. Write: Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, New York. 9.13

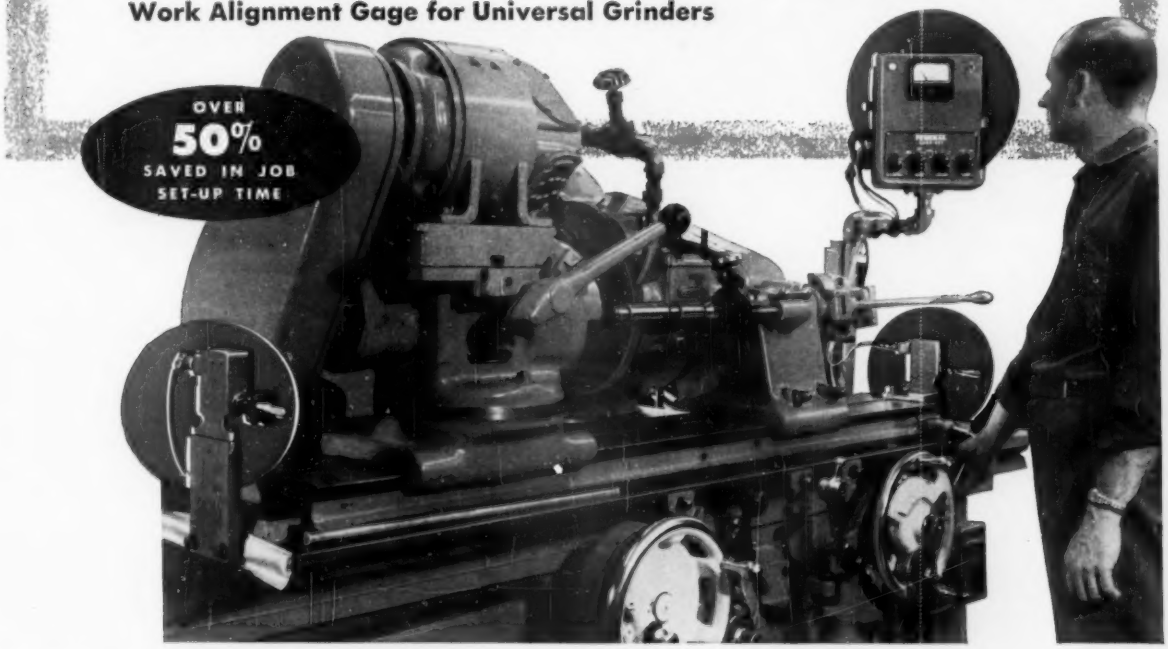
WALDES
TRUARC®
RETAINING RINGS
Waldes Kohinoor, Inc., Long Island City 1, N. Y.

TRUARC RETAINING RINGS . . . THE ENGINEERED FASTENING METHOD FOR REDUCING MATERIAL, MACHINING AND ASSEMBLY COSTS

the Sure-set

FAST ACCURATE ABSOLUTE

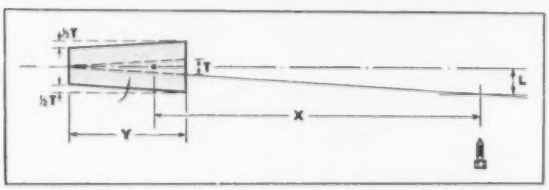
Work Alignment Gage for Universal Grinders



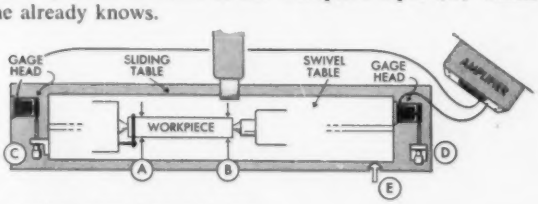
HOW THE SURE-SET PROVIDES *ABSOLUTE* CONTROL OVER WORK POSITIONING

(1) The Sure-Set is an electronic work-positioning gage which guides the operator in making the *exact amount* of swivel table adjustment needed to eliminate unwanted taper or — conversely — to produce a specifically desired taper, so that a part can be produced successfully *WITH ONLY ONE TRIAL CUT.* There is no restriction on workpiece length or table length.

(2) The Sure-Set shows the operator when he has made the table adjustment correctly by showing actual table position. And, because it shows how much *each end* of the table moves, the operator can make correct adjustment, EVEN THOUGH THERE IS PIVOT LOOSENESS, STICK-SLIP, OR ACTUAL BENDING OF THE TABLE . . . conditions which occur in MOST grinders.



(3) The Sure-Set electronically compensates for the difference between length of workpiece (Y) and the distance from table pivot to adjusting screw (X). This is important because it permits the operator to make the correct table adjustment (L) without first having to stop and calculate what it actually should be. The Sure-Set is able to save the operator this calculation by charts, graphs, and mathematics because its meter (graduated in .001" or .0001") reads in terms of the workpiece taper (T) which he already knows.



A HARD JOB MADE EASY

The Sure-Set saves over 50% set-up time by eliminating trial-and-error grinding and repeated checks. Here is the procedure: Take trial cut . . . gage work at two points (A and B) to determine taper . . . set compensating switch on Sure-Set amplifier to match distance between A and B points . . . watching meter on amplifier, zero each gage head by adjustments at C and D . . . adjust swivel table at E until meter reading for *each* gage head matches the amount of taper . . . TAKE FINISH CUT. Total elapsed time — 2 to 3 minutes!

You'll be amazed how much time and money the Sure-Set can save! For further information contact your local FEDERAL representative or write . . .

FEDERAL PRODUCTS CORPORATION
9191 Eddy Street, Providence 1, R. I.

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FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

Inspect your gears the practical, low-cost way

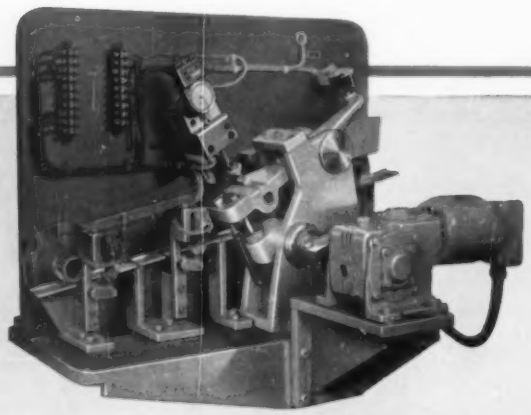
Many gear makers favor Red Ring gear inspection machines because they are precise without being delicate or temperamental — equally effective in either the gear laboratory or the busy production shop. Just practical and economical.

Red Ring machines provide for such Automatic Operations as:

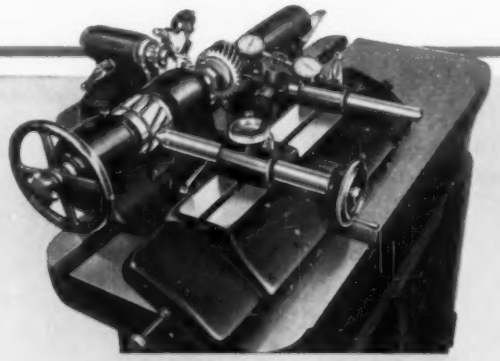
- Gaging of size and helix angle
- Sorting according to size and helix
- Recording of gear measurements

Red Ring machines also check such individual gear characteristics as Index, Eccentricity, Wobble, Lead or Helix, Size and Tooth Parallelism.

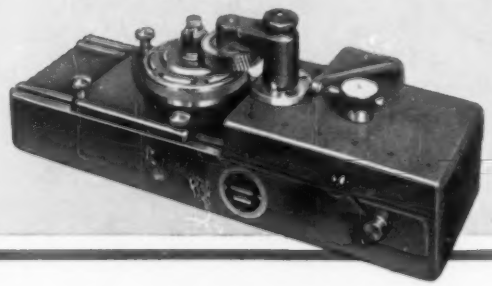
We can't show here the many models now in service throughout industry, but you may have Bulletin C-55-9 which describes them in detail. Why not write for it today?



Automatically checks tooth size of gears with integral flanges too large to pass through conventional feed chutes. In-tolerance, oversize and undersize parts are segregated. (Machine cover removed)



Lead Comparator with an additional interchangeable head for measuring other tooth characteristics. (Tooth spacing head shown)



Rolling fixture provides a rapid check of composite errors and tooth surface roughness.

8287

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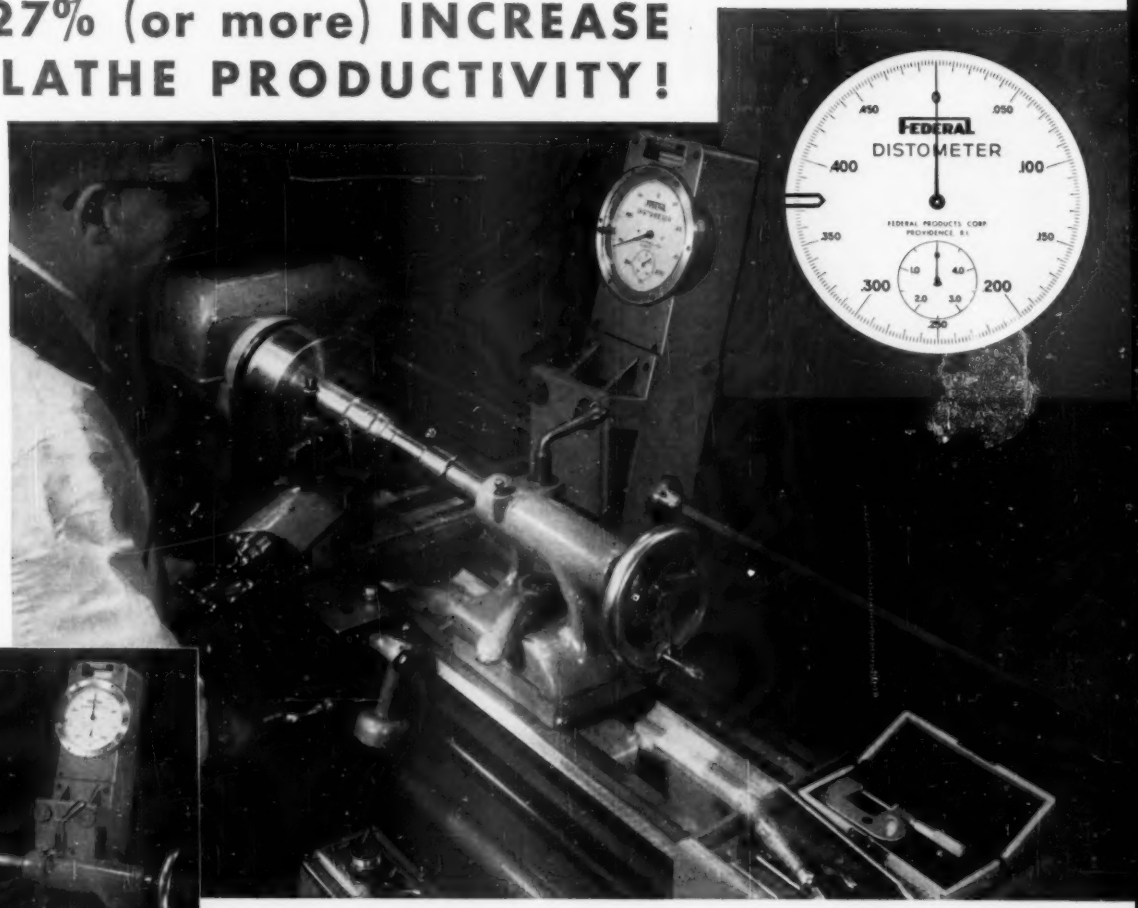

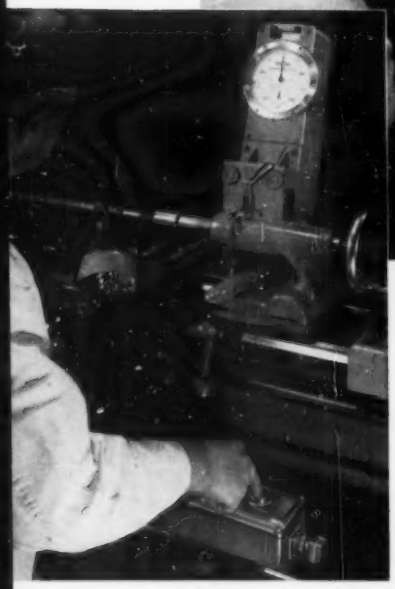

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The DISTOMETER, a totally new precision instrument, greatly increases lathe output . . .

Because —

- It provides a much faster, more convenient and more reliable means of spotting tool position and measuring longitudinal cutting distance than any other available device.
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- It puts accurate, well magnified, man-size readings in front of the operator so he can follow progress of the tool and know instantly when it has covered the required distance.
- It requires no set up, no positioning, no mastering. Ready to measure *directly* at the touch of a button.

ANY MANUALLY OPERATED LATHE . . . OLD OR NEW . . . BIG OR SMALL . . . CAN USE THE DISTOMETER PROFITABLY!

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NEW Semi-automatic Chucking Machine K-20

represented exclusively by

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NOW INCLUDING:

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- Multi-method chucking
- Larger and heavier construction
- Cam shaft accelerator

The CARL HIRSCHMANN COMPANY INC. proudly introduces the New KUMMER K20 and stands ready to back it up with the traditional HIRSCHMANN service.

The KUMMER K20 Semi-automatic Chucker now adds electronic drives and controls, multi-method chucking and larger and heavier construction to its many features to make it one of the most versatile machine tools in the shop.

The KUMMER K20 is two machines on one base. It doubles operator productivity and increases output.

A machine tool of the HIGHEST PRECISION, the K20's cam controlled tool slides carrying up to three tools for each independent head, permit automatic turning, boring, drilling, contouring and generating with SINGLE POINT TOOLS.

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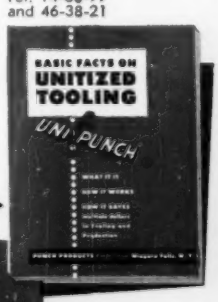

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General Electric announces the new Adjust-O-Breaker toolholder!

Carboloy® toolholder with adjustable chipbreaker lets you adjust from any angle . . . offers any desired adjustment within its range* . . . features "floating" indexable chipbreaker with absolute repeatability.

MORE jobs with *LESS* tooling—that's what you get with this new Carboloy® Adjust-O-Breaker toolholder! No need to have a separate chipbreaker for every cutting job. No need to restrict yourself to toolholders with only two or three chipbreaker settings. Now you can have this versatile new Carboloy toolholder . . . and *adjust it for any chipbreaker setting within its range.**

Available right now from stock in 5 styles, negative rake, for left- and right-hand machining, the Adjust-O-Breaker truly brings new meaning to disposable tooling.

So, to get cutting tool versatility that lets you handle *more* jobs with *less* tooling, check into the complete Carboloy line—Lift-O-Matic (positive rake, negative rake, and tracer), heavy-duty, and the new Adjust-O-Breaker toolholder. The complete line of Carboloy inserts, insert seats, convertible seats, and brazed tooling is the *broadest* in the industry . . . designed to meet *every* tooling need to give you BETTER PROFITS THROUGH BETTER TOOLING.

See your Authorized Carboloy Distributor now. He's listed in the Yellow Pages. *Metallurgical Products Department of General Electric Company, 11101 E. 8 Mile Blvd., Detroit 32, Michigan.*

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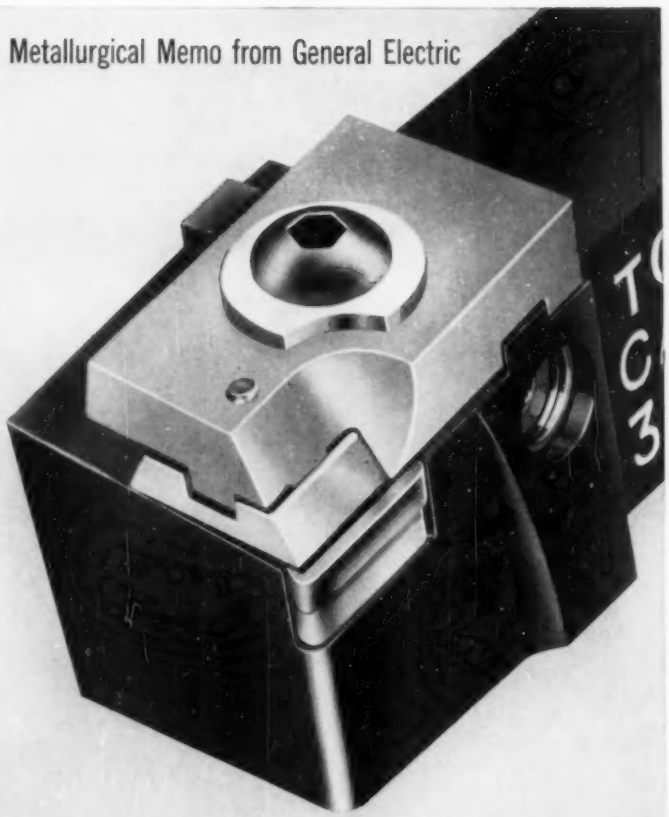
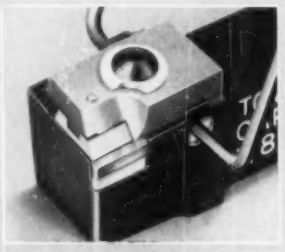
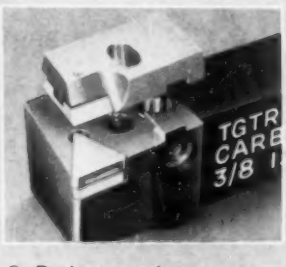


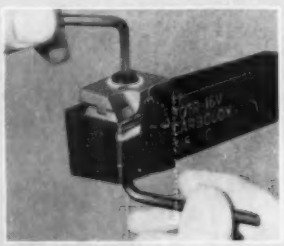
*Sizes 16V and 85V: adjustable range 1/16" to 7/32"
Size 20V: adjustable range 1/16" to 1 1/32"



1. Chipbreaker setting adjusts to any width within range.* Set screw with two open ends provides access from either side. No springs to adjust.



2. Design permits absolute repeatability of settings. Floating chipbreaker is indexable. Can't drop out when clamp is loosened.



3. Clamp screw is accessible from top or bottom; allows easy indexing or replacement even when toolholder is vertical or upside down.

4. Standard disposable inserts, Carboloy insert seats and convertible seat are used with toolholder. Insert seats are indexable and self-aligning.

LAPOINTE

announces

exclusive distributorship for

British-made PRECISION
MACHINE TOOLS

★ LAPOINTE MACHINE COMPANY,

with its extensive sales and service staff, now offers a wide range of machine tools of exceptional quality.

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ASSOCIATED BRITISH MACHINE TOOL MAKERS, LTD.

THE BUTLER MACHINE TOOL CO., LTD.
THE CHURCHILL MACHINE TOOL CO., LTD.
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J. PARKINSON & SON, LTD.
H. W. WARD & CO., LTD.

★ ALL FACILITIES OF THE LAPOINTE PLANT

in Hudson, Mass., including engineering and production personnel, are at the disposal of this line.

BUTLER CHURCHILL LANG PARKINSON WARD

ASSOCIATED BRITISH MACHINE TOOL MAKERS, LIMITED

Here's what brought it about:

Lapointe was the first American builder of metal-cutting machine tools to acquire a plant in Great Britain, and long association and acquaintance with British-made machine tools, used in the Lapointe plant since 1919, resulted in the development of a high regard for the quality of those tools and the integrity of their builders.

Lapointe selects best British machines. Consequently, with the world's changing trends in the marketing of machine tools, Lapointe recently decided to make a selection of the best British-built general and special purpose machines and sell them, fully tooled, in this country, using the complete Lapointe sales, service, and engineering structure in this endeavor. The entire line is backed by the American Lapointe manufacturing plant, with its outstanding reputation as an important builder of machine tools.

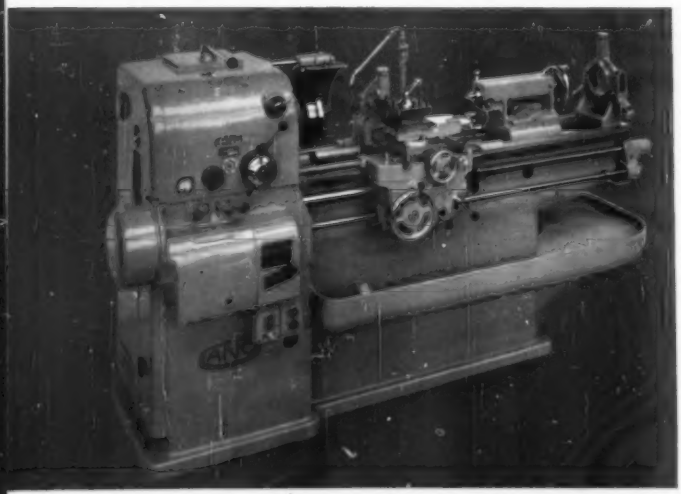
Lapointe engineers inspect. Every British-made machine will be carefully inspected and checked-out by inspectors from the Lapointe plant in England, before shipping. Since these Lapointe men are thoroughly acquainted with the exacting requirements for machine tools in the United States, this procedure for final inspection provides complete assurance that the machine is *right,* and as ordered, before it leaves Britain.

Parts readily available. A stock of replacement parts will be maintained in Hudson, Mass., for quick shipment. There will also be blueprints in Hudson, from which to produce a part needed in an emergency, not carried in stock. All measurements are in inches; the English System avoids any conflict. The full complement of Lapointe service engineers and service men, including all the facilities of the large Hudson plant, will take care of any maintenance and tooling needs concerning these British machines.

Deliveries excellent. Some machines can be shipped from stock; others will be shipped on a schedule at least comparable to that required for similar machines from a machine tool builder in the United States.

Model J6 Lathe, 13" and 17" Swing

12 Spindle speeds — Nickel chrome, hardened and ground gears • Pre-loaded spherical roller bearing spindle and the bearings pump lubricated with filtered oil • Totally enclosed multi-feed gear-box • Pump lubrication to feed gear-box, apron and saddle • Hardened steel wear strips on under slideway faces of saddle • All controls conveniently grouped.

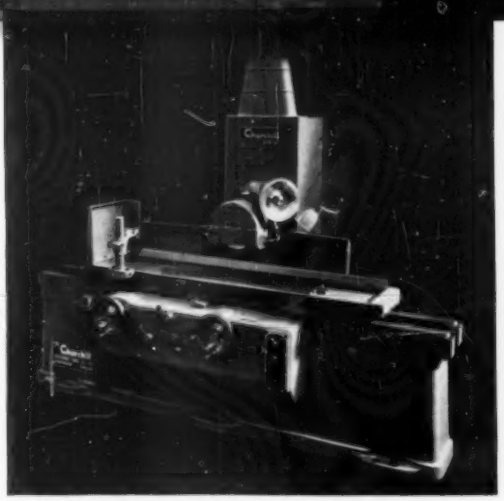


LAPOINTE LANG

Precision Engine Lathes

Precision Engine Lathes, 13-in. to 36-in. swing
Surfacing & Boring Lathes, 13-in. to 48-in. swing
Hollow Spindle Engine Lathes; hole through spindle 10½-in. dia., 12½-in. dia. and 16½-in. dia.
Sliding Bed Lathes, 30-in. and 36-in. swing
Unitrace Profiling Lathes, 16-in., 17-in. and 16/20-in. swing over bed
Hydrotrace Profiling Lathes, 20-in. and 24-in. swing over bed
Pneumatic and Hydraulic Chucks

For literature write to LAPOINTE



Model OSB Surface Grinding Machine
42" x 10" x 16"

LAPOINTE CHURCHILL

Precision Grinding Machines

Universal Grinders, 8-in. to 24-in. swing
Universal Tool and Cutter Grinders, 8-in. to 12-in. swing
Cylindrical Grinders, 6-in. to 60-in. swing
Roll Grinders, Traveling Wheelhead and Moving Table Crankshaft Grinders
Horizontal Spindle Surface Grinders, 6-in. to 15-in. wide table
Horizontal Spindle Surface Grinders, Rotary Table
Plano-Type Surface Grinders, horizontal and vertical spindle
Vertical Spindle Surface Grinders, 10-in. to 22-in. wide table
Plain Internal Grinders, 12-in. to 36-in. swing
Automatic-Sizing Internal Grinders
Internal Cylinder Grinders
Centerless Grinders
Spline Grinders
Cam Grinders
Slideway Grinders
Grinding Machines for the Railroad Shop

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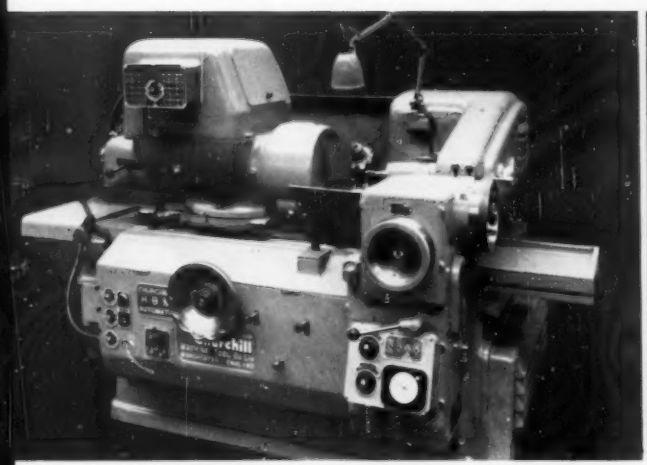
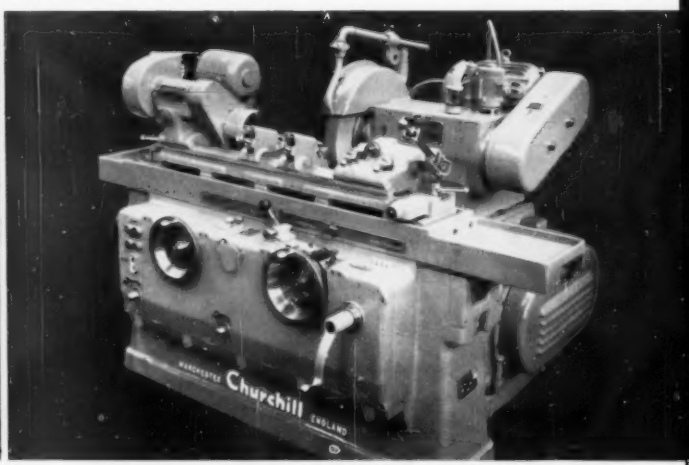


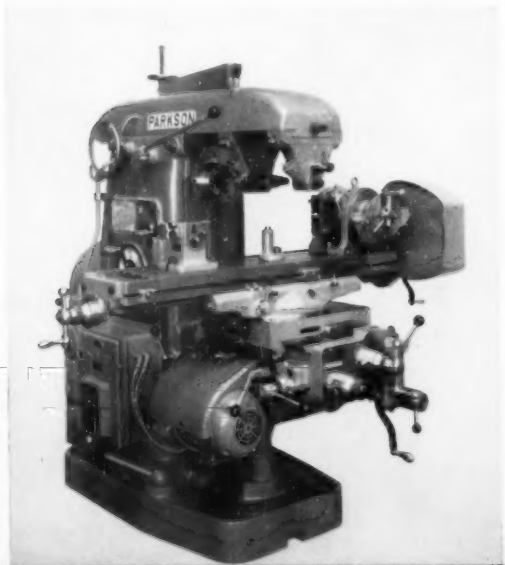
Model HBM Internal Grinding Machine



Model AW Plain Grinding Machine 6" x 18"

No. 2 NU Universal Miller

Table, 51" x 11½" • Longitudinal Feed, 28" • Cross Feed, 10" • Spindle Center to Table Top, max. 18" • Table Swivel each side of center, 50° • Spindle Speeds (12), 29 to 775 r.p.m. • Spindle Motor, 5 h.p. at 1430 r.p.m. • Feed Motor, 1½ h.p. at 950 r.p.m.



LAPOINTE PARKINSON

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Plain Horizontal Milling Machines, knee type, 30-in. to 40-in. traverse
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Sunderland Gear Shapers for gears up to 15 ft. dia.
Sunderland Gear Cutters
Sunderland Gear Cutter Sharpening Machines
Gearbur Machines

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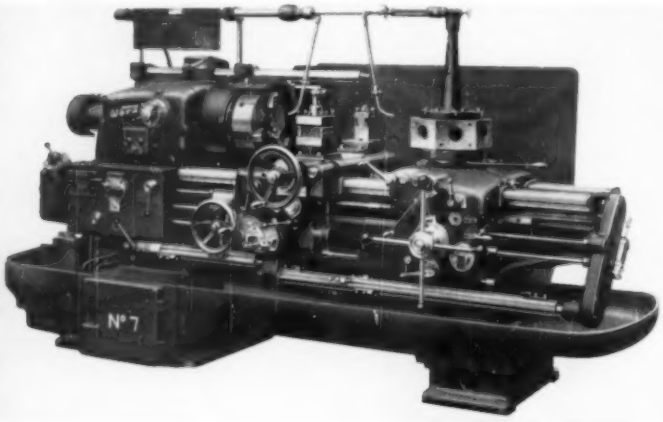
No. 7 Prelector Turret Lathe

Patent hydraulic pre-selecting head-stock • 12 spindle speeds, both forward and reverse, (25-1,000 r.p.m.) • Bed protected by stainless steel covers • Screw-cutting motion • Automatic lubrication • Quick power traverse • 2½ in. bar 16 in. swing.



LAPOINTE WARD

Ram Type Turret Lathes
Saddle Type Turret Lathes

- **Ram Type Turret Lathes** with bar capacity from 1¼-in. to 2-in. and swing from 13-in. to 16-in.
- **Saddle Type Turret Lathes** with bar capacity from 2½-in. to 8½-in. and swing from 16-in. to 35-in.
- **Collet chucks, bar feeds, standard toolholders and special equipment** for Ram Type and Saddle Type Lathes

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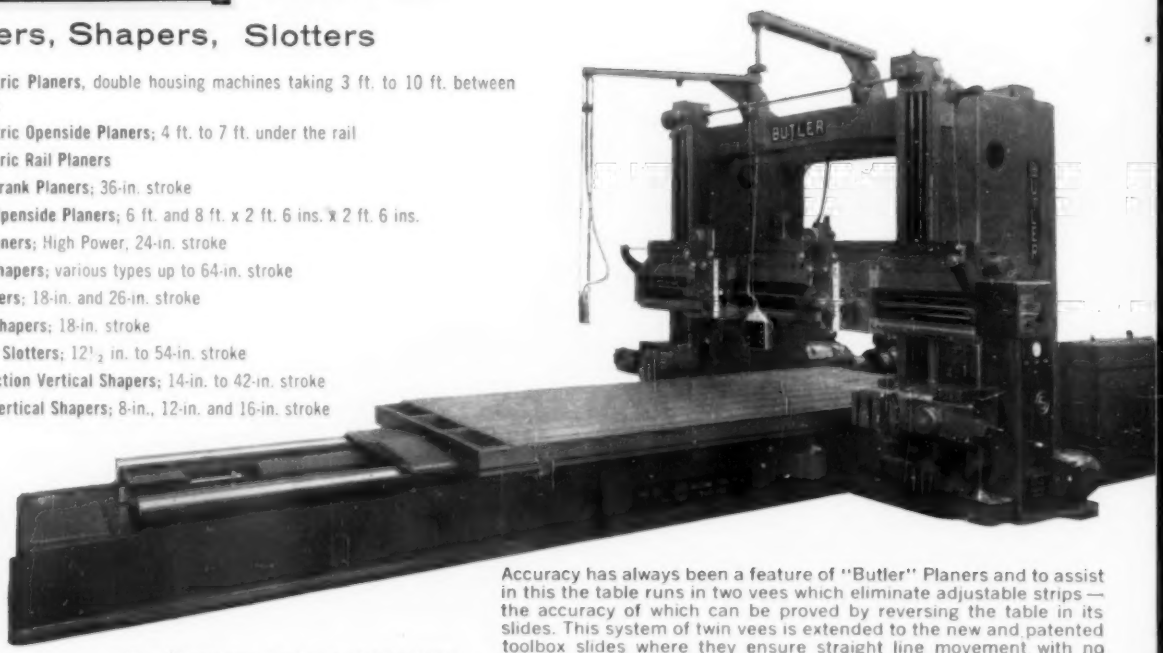
LAPOINTE BUTLER

Planers, Shapers, Slotters

Spiral-Electric Planers, double housing machines taking 3 ft. to 10 ft. between housings
Spiral-Electric Openside Planers; 4 ft. to 7 ft. under the rail
Spiral-Electric Rail Planers
Openside Crank Planers; 36-in. stroke
Hydraulic Openside Planers; 6 ft. and 8 ft. x 2 ft. 6 ins. x 2 ft. 6 ins.
Axlebox Planers; High Power, 24-in. stroke
Draw-Cut Shapers; various types up to 64-in. stroke
Super Shapers; 18-in. and 26-in. stroke
Hydraulic Shapers; 18-in. stroke
Heavy Duty Slotters; 12½ in. to 54-in. stroke
High-Production Vertical Shapers; 14-in. to 42-in. stroke
Precision Vertical Shapers; 8-in., 12-in. and 16-in. stroke



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Accuracy has always been a feature of "Butler" Planers and to assist in this the table runs in two vees which eliminate adjustable strips — the accuracy of which can be proved by reversing the table in its slides. This system of twin vees is extended to the new and patented toolbox slides where they ensure straight line movement with no loose adjusting strips.

Department TE

LAPOINTE MACHINE COMPANY

HUDSON, MASSACHUSETTS

Exclusive U. S. Agent for

ASSOCIATED BRITISH MACHINE TOOL MAKERS, LTD.

LAPOINTE

British-made MACHINE TOOLS

Printed in USA

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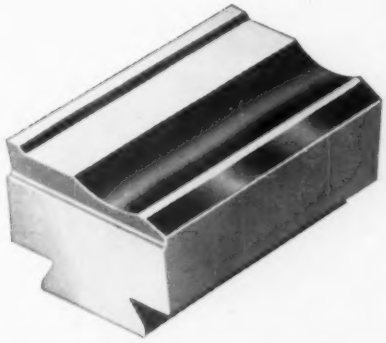
makes all types of
high-speed form tools—



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we make all types
of carbide-tipped
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and more special cutting tools of all kinds
than any other tool manufacturer?

For more than half a century National Tool Company has supplied high quality precision cutting tools to the metal working industry. When your job requires special cutting tools call your National Tool representative. His assistance is yours for the asking whether you're interested in one *special* tool or a complete tooling program.

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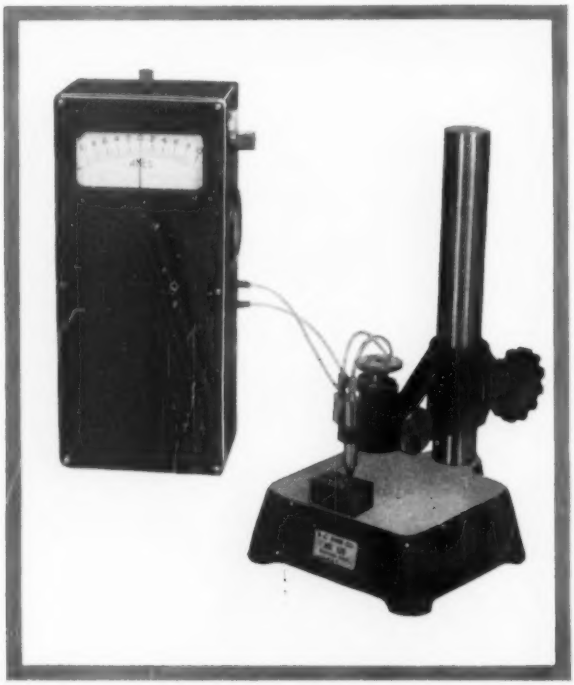
B. C. Ames has perfected a new concept in air gauging... ACCU-FLOW... which offers extremely fine measurement and unusual stability.

Key feature of the ACCU-FLOW system is a new patented nozzle which provides a high degree of sensitivity and excellent linearity.

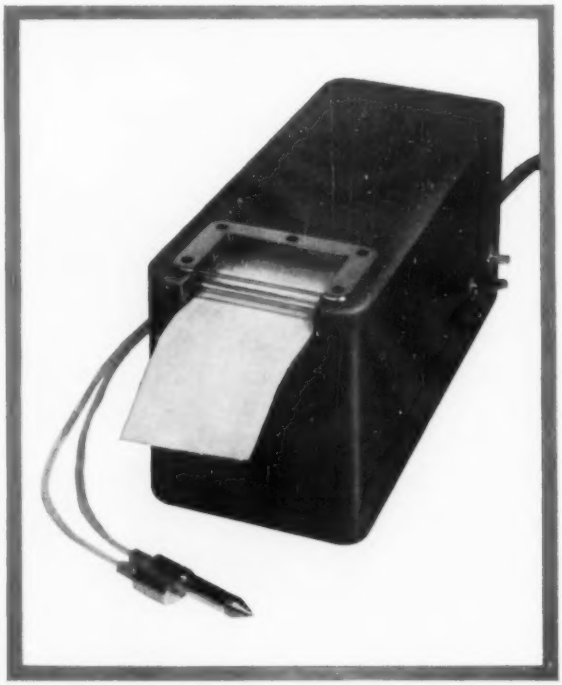
ACCU-FLOW is the answer to many measuring problems that were once considered impossible to solve. The ACCU-FLOW system includes: *gauges that provide a continuous record of wire diameter, and determine the roundness of balls or shafts... a contour tracer that permanently records contours in greatly enlarged scale... automatic sorting gauges... a non-contact follower gauge* and *a gauge for measuring grinding variations.*

For complete information on the entire line of AMES air gauging equipment, write for new ACCU-FLOW folder.



AG5 ACCU-FLOW Air Gauge

The versatility of ACCU-FLOW equipment is indicated by Model AG5. Adaptable to less than five millionths of an inch tolerances, the AG5 can be used as a contact comparator, flatness comparator, depth gauge, hole gauge, continuous non-contact measurer or comparator, and a grinding gauge.



AG7 ACCU-FLOW Air Gauge Recorder

The AG7 Air Gauge Recorder gives you a permanent record of continuous measurement. Measurements are recorded on a 2"-wide chart paper by a Sanborn "hot needle." As in other ACCU-FLOW models, the nozzle may be placed a considerable distance from the recording unit.

*Trademark of B. C. Ames Co.

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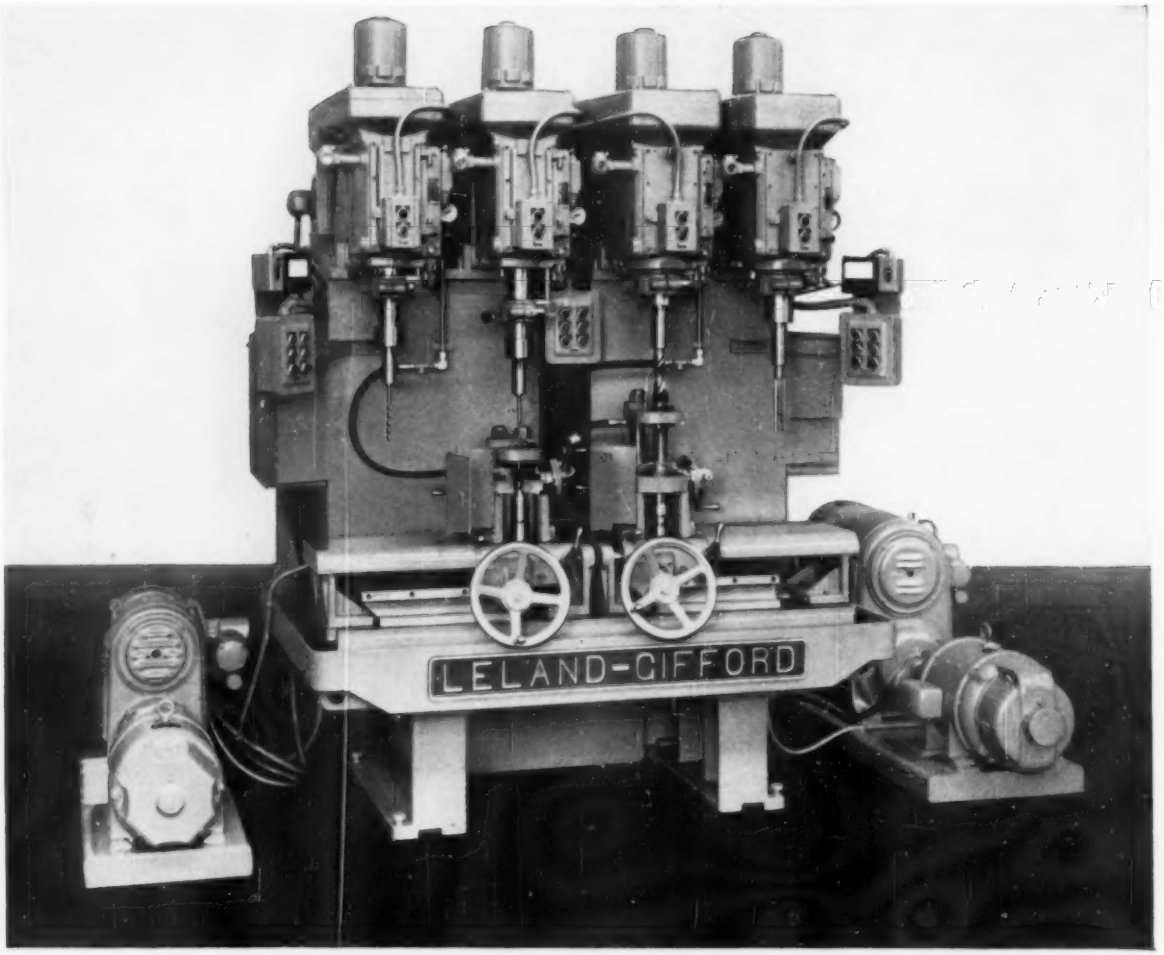
MANUFACTURERS OF MICROMETER DIAL INDICATORS AND GAUGES

USE READER SERVICE CARD, CIRCLE 31

USE READER SERVICE CARD, CIRCLE 32



Designed for maximum utilization —

It goes without saying that Leland-Gifford special drilling machines deliver the production you want to the precision standards you set. But Leland-Gifford also has in mind the importance of design for maximum utilization to make your purchase of a Leland-Gifford machine a gilt-edge, quick return investment.

For Automatic Drilling at its best . . . be sure to see Leland-Gifford

CALL THE OFFICE NEAR YOU

THE JOB: Drill and ream a complete line of screw machine master collets and feed fingers ranging from $\frac{1}{8}$" to $1\frac{1}{4}$" diameter.

THE MACHINE: A dual operating Leland-Gifford special with two work-holding fixtures and four standard self-contained drilling units equipped for either plain or step feed. Workpieces are drilled in one location, indexed to second location and reamed. Spindle speeds are precisely controlled through variable frequency input to ac spindle motors. Hydraulic feed is infinitely adjustable with separate motors driving hydraulic pumps at constant speed regardless of spindle speed.

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Every inch a "Light-Heavyweight" . . .

New

WT WALKER-TURNER

20″ Variable Speed BAND SAW

With its massive construction and many other outstanding features, this new Walker-Turner 20″ Band Saw is a natural for heavy duty production work. Its variable speed drive permits dialing any speed from 50 to 4500 fpm—*while the machine is running*—for fast, efficient cutting of metals (even tough steel), wood, or plastics. Its big, heavily-ribbed tilting table rests on widely-spaced front and back trunnions and has an additional side brace. And, like the popular W-T 16″ Band Saw, this new "Light-Heavyweight" has safe, accurate guides that support the blade down to the work; solid bar upper guide post; and rugged ball bearing thrust support.

Your W-T dealer will be glad to give you details. He's listed under "Tools" in your classified telephone directory.

FREE CATALOG

Write to Walker-Turner Division, Rockwell Manufacturing Company, Dept. WA-25, 400 N. Lexington Ave., Pittsburgh 8, Pa.

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another fine product by
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Serving you through the best distributors from coast to coast

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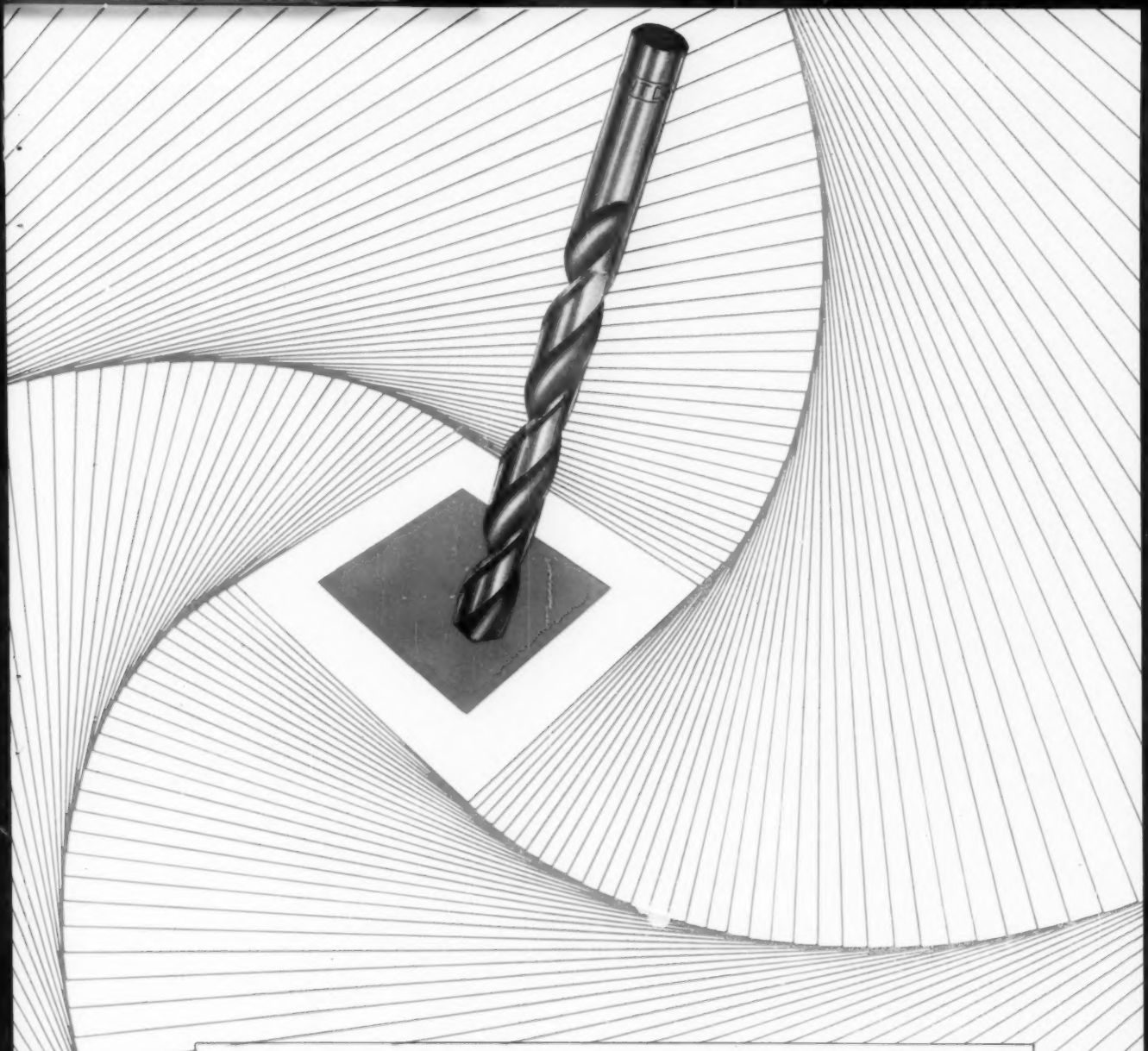

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Every UNION cutting tool is an exact geometric duplication of every other of the same size and type. This precise duplication of UNION drills assures consistently high production, reduces drill consumption and costly rejects. For best results, specify UNION drills, reamers, milling cutters, end mills, gear cutters, hobs, carbide tools, and inserted blade cutters. Available nationally through UNION Distributors and stocked in UNION warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, San Francisco.

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HERE'S PROOF OF PERFORMANCE

"the spindle capacity, 'beef' of the machine, and ease of operation are really impressive . . ."*

RONNINGEN MANUFACTURING COMPANY

Big hole-thru-spindle capacity ($3\frac{1}{16}$" in 17" lathe — $2\frac{1}{16}$" in 15" lathe — $1\frac{9}{16}$" in 13" lathe) is only one of the *plus value* features you'll find in Clausing-Colchester lathes. Here's a partial list of the many more:

- **geared-head drive powered by multiple V-belts**
- **totally enclosed head and quick-change gear box, oil bath lubrication**
- **multi-splined shafts and gears**
- **large tapered roller bearings, with oil flow lubrication . . . *most accurate bearings known to industry***
- **high-tensile steel spindle, hardened tapered nose**
- **separate rod for power feeds**
- **induction hardened, precision ground bed ways**
- **precision construction throughout to American standards of toolroom lathe accuracy.**

*The result — this user report is typical: "We like everything about our Clausing lathes. The spindle capacity, 'beef' of the machine, and ease of operation are impressive. The finish we get is phenomenal. And, you just can't beat Clausing geared-head lathes for value!" Ronningen Manufacturing Company.

NO OTHER LATHE GIVES YOU SO MUCH FOR SO LITTLE!

13" cabinet base models, including motor and controls, start at $2302; 15" cabinet base at $3221; 17" at $5070. You owe it to yourself to investigate Clausing-Colchester before investing in any lathe.

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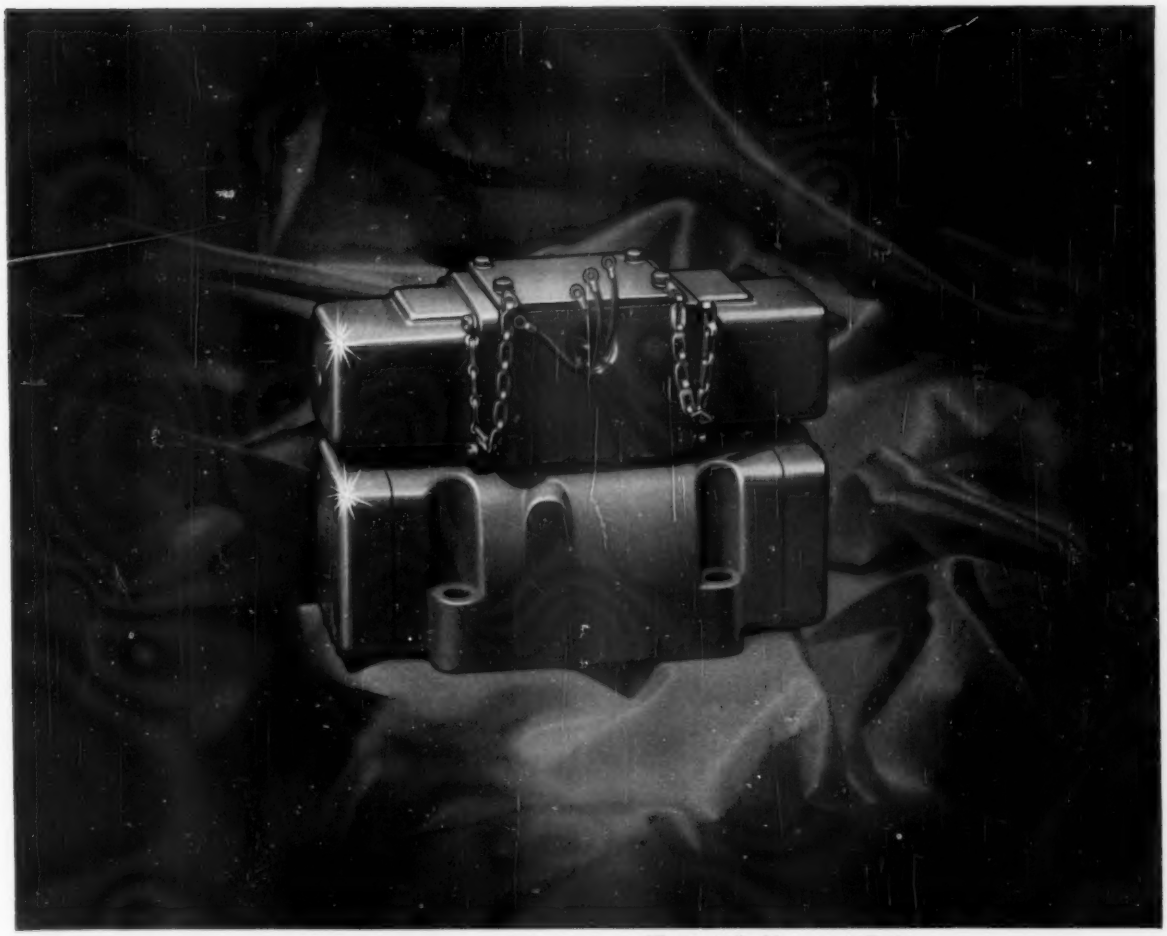

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Piggy Back Hydraulic Control Valve
Meets J.I.C. Standards

Look to Logan

the ultimate in hydraulic valve design

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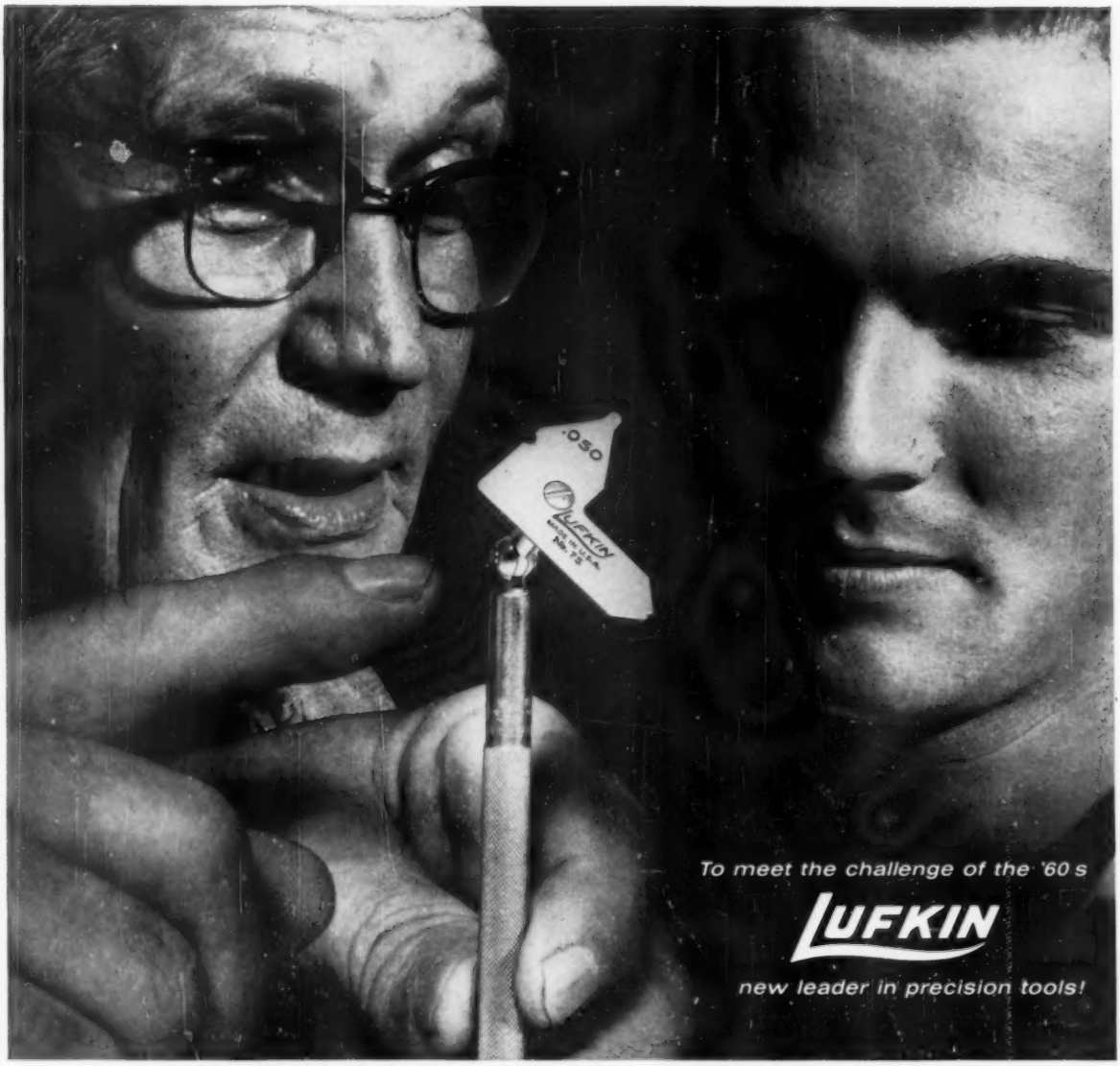


"The fabulous '60s, with tremendous technological advances predicted, will require this type of perfectionist precision tool . . . and, son—

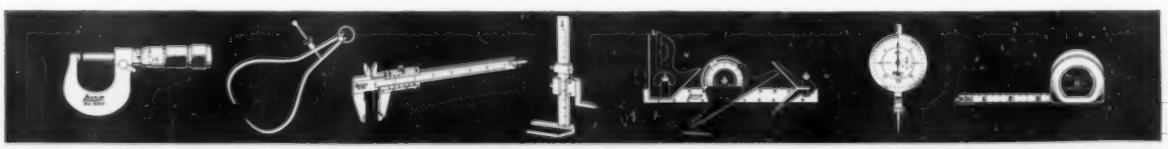
only Lufkin offers you a decimal radius gage!"

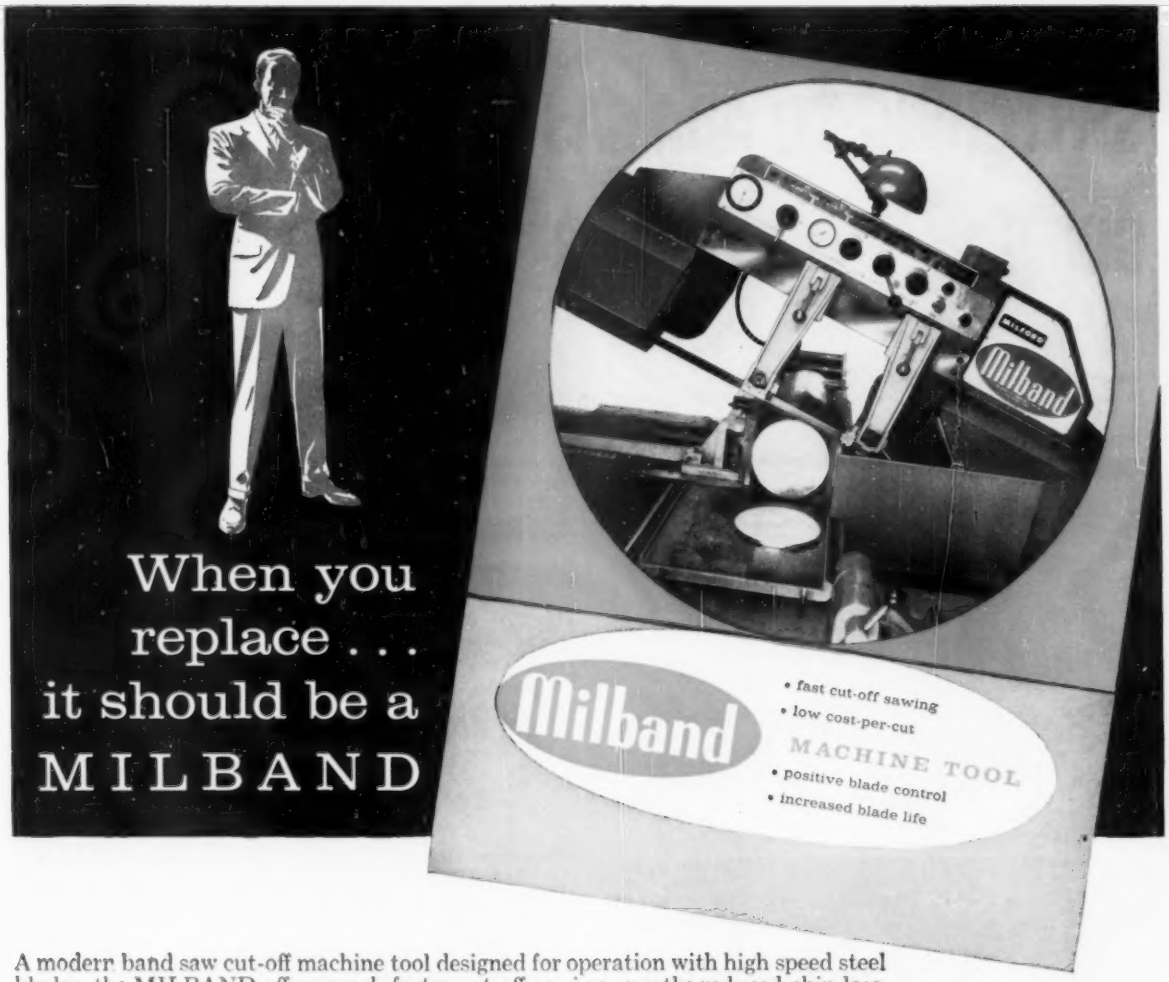
This unique radius gage is an excellent example of why Lufkin is the new leader in precision tools. It is designed to save the craftsman time and effort . . . to give him greater accuracy with readings from 0.10 to 1.000, and no burrs to throw him off.

Hardened stainless steel blades, too, for a lifetime of accurate service. And the holder for this No. 75 gage is 4½" long, reaches into small, out-of-the-way places. Adjusts over 180° arc to keep blade edge perpendicular to surface measured.

Durable vinyl case holds blades in individual pockets, makes selection fast and easy.

See your industrial distributor. He knows precision tools and can show you how Lufkin leads in design and craftsmanship. His stock is maintained to fit your needs. LUFKIN, Saginaw, Mich.





A moderr band saw cut-off machine tool designed for operation with high speed steel blades, the MILBAND offers much faster cut-off sawing, greatly reduced chip loss, and cuts consistently smoother, straighter and more accurately. *Your* next investment in cut-off equipment *should* be a MILBAND!

The circular featured above covers all the important facts about the many advantages offered by continuous-action band sawing. It also covers all the design and construction features that make the MILBAND Machine Tool today's (AND tomorrow's) wisest investment in a cut-off machine. Use the coupon below to send for your free copy, and check the facts for yourself. If you want additional dollars-and-cents proof, we'll be glad to run actual tests on a MILBAND Band Saw Machine Tool and submit a complete time-and-cost analysis report.

MILBAND MACHINE TOOL DIVISION

THE HENRY G. THOMPSON & SON CO. NEW HAVEN 5, CONNECTICUT

Saw Specialists For Over 80 Years

MILFORD — SAW & BAND SAW BLADES — MACHINES • STOCK • SAWS • GROUND FLAT STOCK

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☐ Please send my free copy of the MILFORD circular giving complete information on the modern, band saw cut-off method with the MILBAND Band Saw Machine Tool.

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SWITCHING TO ADAMAS CARBIDE GRADE 548 GIVES OLIVER 170 MORE PIECES PER INSERT

-cuts downtime by 75%

Oliver Corporation—never satisfied until they are sure they have the best—wanted greater production, per carbide cutting edge, in machining front tractor wheels. Shown discussing the problem are Lyle Bushbaum, Divisional Foreman; A. G. Obermeier, Shop Supt.; of Oliver's Charles City, Iowa plant; and Adamas Service Engr., Walter Sukiennik.

The machines in use are P & J automatic turret lathes. Using brazed tools on the hard cast iron parts, production never exceeded 50 pcs. per sharpening. Mr. Bushbaum, examining the operation, considered using throwaway inserts but questioned their ability to stand up under the heavy shock conditions.

OLIVER CORPORATION
"NEVER SATISFIED UNTIL
IT HAS THE BEST"
BUYS TUNGSTEN CARBIDE
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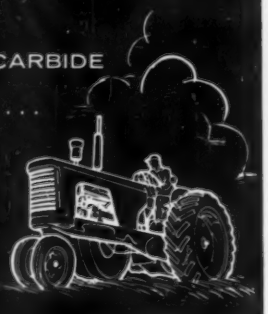
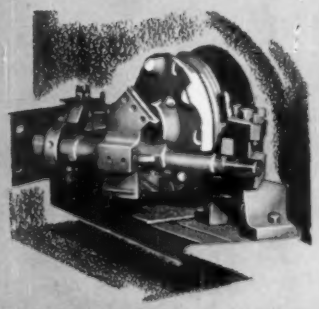
If you are interested in improved efficiency, economy, quality — let's hear from you . . . the coupon is for your convenience.





It was finally decided to set up the lathes with Adamas' Dex-A-Tools and Grade 548 throwaway inserts. This combination proved to be very rugged, and efficiently handled the operations involving a series of interrupted cuts of 3/16" in depth, with a .017 feed at 340 sfpm.

The change to Adamas' Dex-A-Tools and Grade 548 enables Oliver to step up production to 480 pieces per carbide insert and drastically reduce downtime. This is in sharp contrast to the previous output of 50 pcs. per sharpening with a well known competitive grade. Production per corner now averages 80-100 pcs.

Producers of
Tungsten Carbide Tools,
Tool Tips,
Dies, Wear Parts
Dex-A-Tool

ADAMAS CARBIDE CORPORATION
KENILWORTH, NEW JERSEY

☐ Please send new Adamas Catalog No. 359 ☐ Please have an Adamas representative call ☐ Please send new Adamas Carb-A-Guide Selector

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3112

NEW from DoALL

STRAIGHT FLUTE CHUCKING REAMERS

MINIATURE

...in wire sizes 61 through 80 — 1/64 and 1/32 fractional sizes

Developed for the growing miniaturized products field, these DoALL Straight Flute Chucking Reamers now make DoALL's stock of reamers the most complete on the market. They're all ground from the solid, are uniformly hardened throughout, offer greater cutting ability.

All DoALL Chucking Reamers feature fine, smoothly ground flutes for proper chip disposal. Flutes are machine-ground—*on both faces*—from perfectly hardened steel. You get a perfect rake angle and flute contour—for the full length of the flute. Results: the ultimate in cutting ability, faster and cleaner chip removal, maximum service life.

Your nearby DoALL Store carries over 500 sizes and types of Chucking Reamers —in wire, letter, fractional, .001 over and under, and dowel pin sizes in either straight flute, right-hand spiral or left-hand spiral. You'll find many sizes and types as standard that other sources list as special. Try DoALL Reamers the next time you order—and see the difference.

A Complete Line of Standard Reamers

Here are a few of the many types of reamers carried by our local DoALL Sales Service Store:

D-557—Taper Shank	D-581—Die Maker's	D-534—Stub
D-542—Rose Chucking	D-521—Shell	D-586—Bridge
D-500—Hand	D-1001—Expansion	D-596—Taper
D-591—Taper Pin	D-506—Jobber's	

DoALL Reamers also available in sets—28 different assortments.

FREE—new reamer chart—for wall, desk or toolbox use. Lists DoALL Chucking Reamers ½-inch diameter and smaller by decimal size and nominal size. Get yours from your local DoALL Store.

CT-58

THIS IS A TYPICAL DoALL STORE

The DoALL Company, Des Plaines, Illinois

One of a series

Resolving the driver-car-road complex

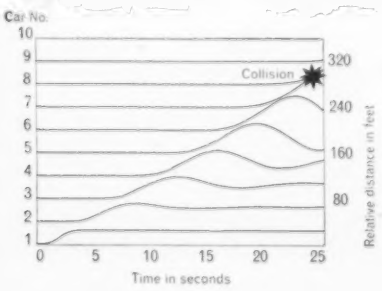
The manner in which vehicles follow each other on a highway is a current subject of theoretical investigation at the General Motors Research Laboratories. These studies in traffic dynamics, coupled with controlled experiments, are leading to new "follow-the-leader" models of vehicle interaction.

For example, conditions have been derived for the stability of a chain of moving vehicles when the velocity of the lead car suddenly changes – a type of perturbation that has caused multiple collisions on modern superhighways. Theoretical analysis shows that the motion of a chain of cars *can be stable* when a driver accelerates in proportion to the relative velocity between his car and the car ahead. The motion is always unstable when the acceleration is proportional only to the relative distance between cars. Experimentally, GM Research scientists found that a driver does react mainly to relative velocity rather than to relative distance, with a sensitivity of reaction that increases with decreasing distance.

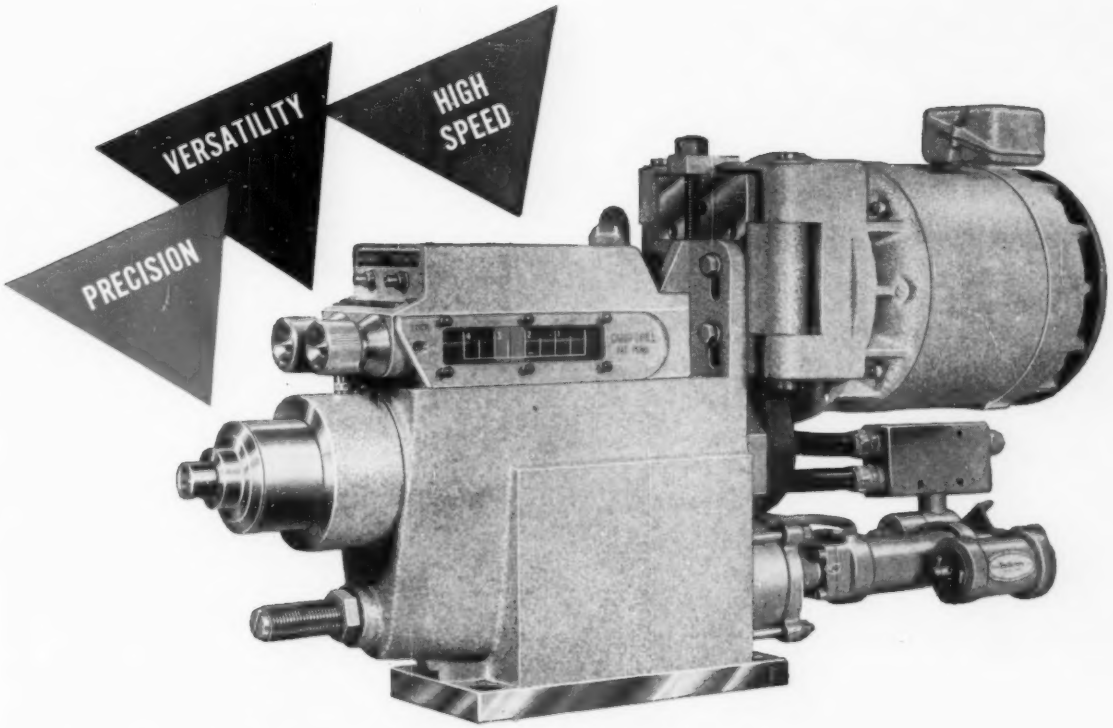
Traffic dynamics research such as this is adding to our understanding of intricate traffic problems – what causes them, how they can best be resolved. The study is an example of the ways GM Research works to make transportation of the future more efficient and safe.

General Motors Research Laboratories

Warren, Michigan



Relative positions of 10 hypothetical cars after lead car goes through maneuver. Amplitude of instability increases, resulting in a collision between 7th and 8th cars.



are a few of the outstanding features of the

BELLOWS "Carbi-Drill" DRILL UNIT

- Capacity up to 5/8" diameter drill in mild steel.
- Runout will not exceed .001" T.I.R. in full 4" stroke.
- Depth accuracy .003" with standard limit switch; .001" with optional Bellows BT-1 Timed Dwell Control.
- Stroke adjustable from 1½" to 4", with optional stops to permit shorter stroke lengths. Thrust is equal to 10 times applied air pressure.
- Spindle speeds available from 609 RPM to 6275 RPM.

This rugged, heavy-duty drill unit is ideal for tool-room built special purpose machinery for drilling, tapping, reaming, counterboring, etc. It can be mounted in any position. Units can be easily synchronized electrically with each other or with other Bellows "Controlled-Air-Power" devices for fully automatic operation. Air-powered rapid advance, controlled hydraulic feed rate, air-powered rapid retract provide maximum speed with feed rate adjustable for any tool working in any material.

Take a quick rundown of the main features of this versatile "CARBI-DRILL" unit, then write for a copy of Bulletin CD-17, which gives complete details. Address Dept. TE-160, The Bellows Co., Akron 9, Ohio. In Canada, Bellows-Valvair, 14 Advance Road, Toronto 18, Ontario.

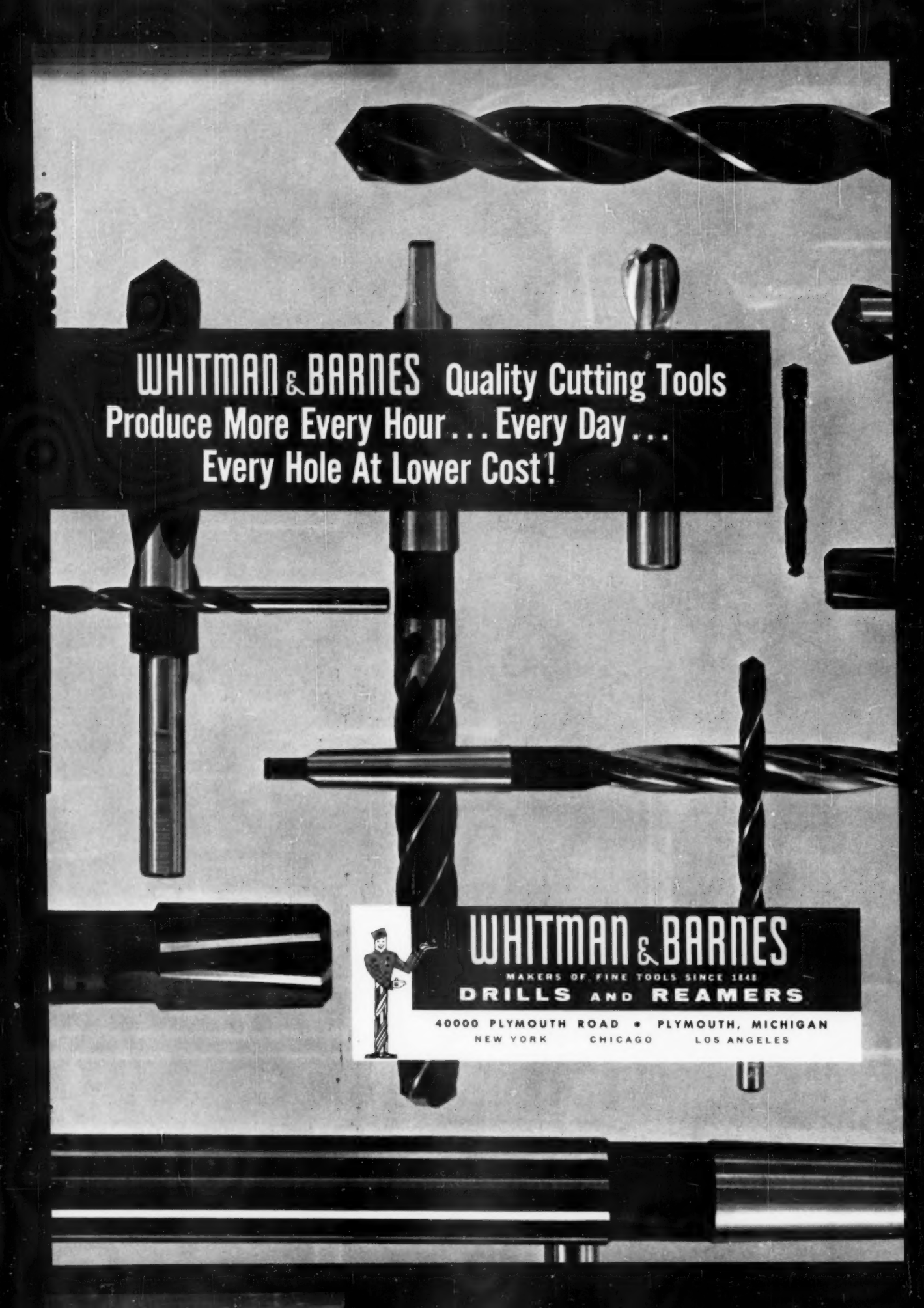
1325-B-1

The Bellows Co.

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

AKRON 9, OHIO

OTHER INDUSTRIAL DIVISIONS OF IBEC: Sinclair-Collins Valve Co., Valvair, Akron, Ohio • V. D. Anderson Co., Cleveland, Ohio


WHITMAN & BARNES Quality Cutting Tools
Produce More Every Hour... Every Day...
Every Hole At Lower Cost!
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DRILLS AND REAMERS
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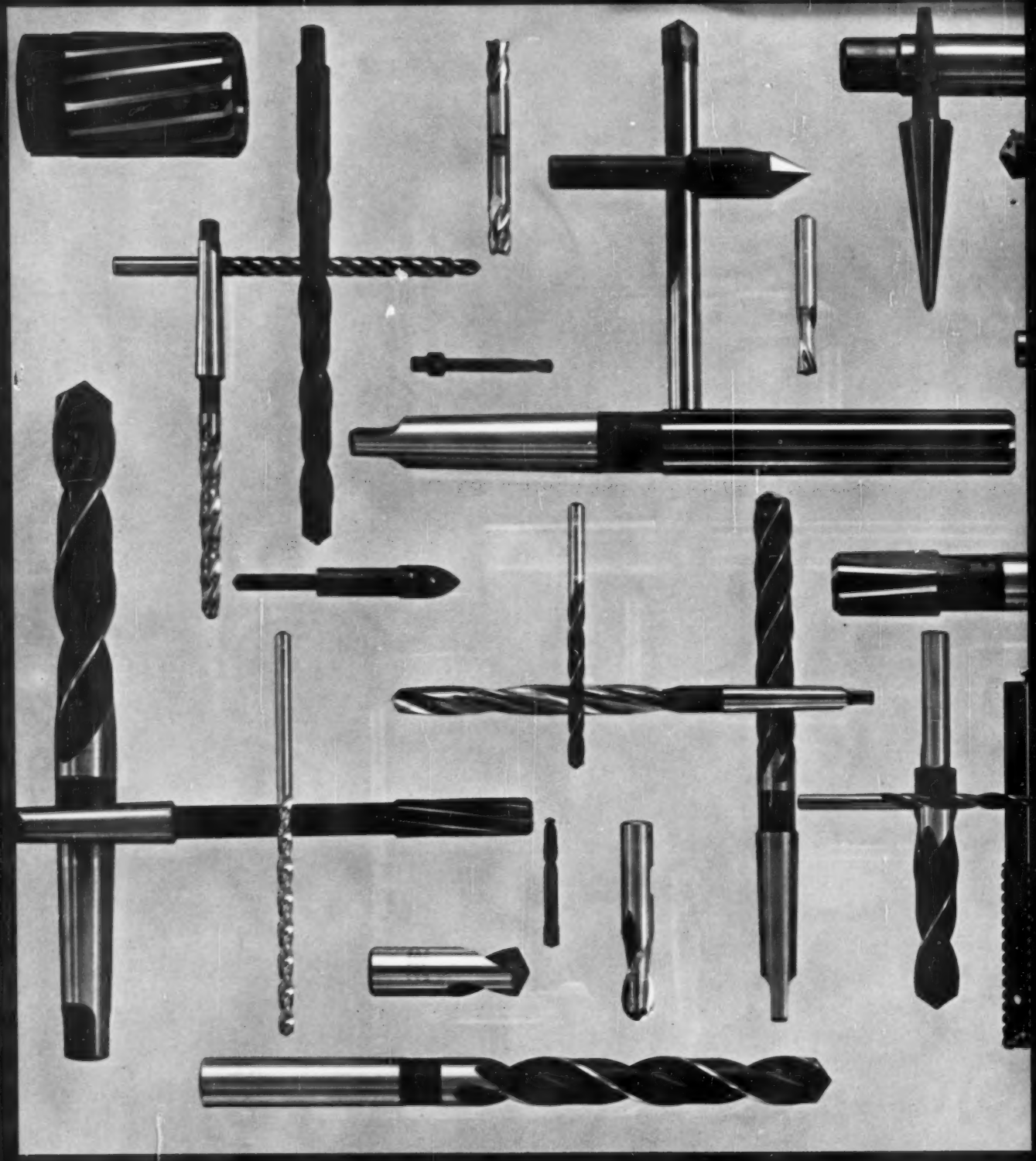
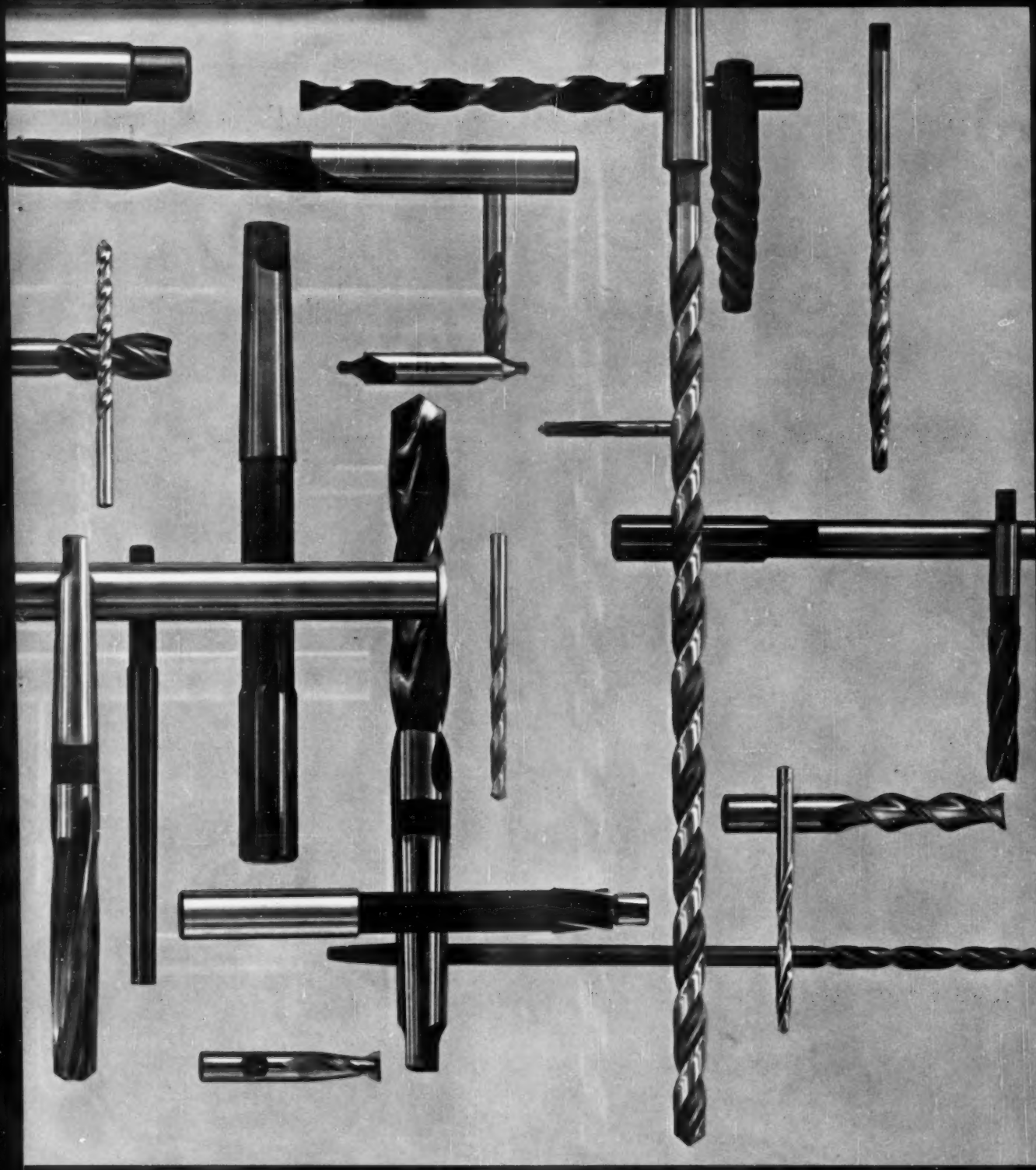


WHITMAN & BARNES Cutting Tools

Are More Than Product Lines . . . They're

Your Partners in Production Progress



In your constant fight against operating costs, the initial price of cutting tools is NOT your answer—realistic, long-range economy is! With an unequalled selection of application tested standard tools . . . with superior special tools . . . with the best in engineering and technical assistance . . . Whitman & Barnes guarantees to help you secure higher production, improved product quality AND lower production costs!

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Actual companies . . . actual applications . . . actual problems. All are detailed in this free brochure. It provides on-the-production-line facts and figures as to how and why Whitman & Barnes cutting tools can effectively cut costs in a wide variety of applications and materials. Just fill in the coupon below for your free copy.

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☐ Please send me your free Case History Brochure.

☐ Please have a W&B representative call to discuss cutting tool problems. No obligation, of course.

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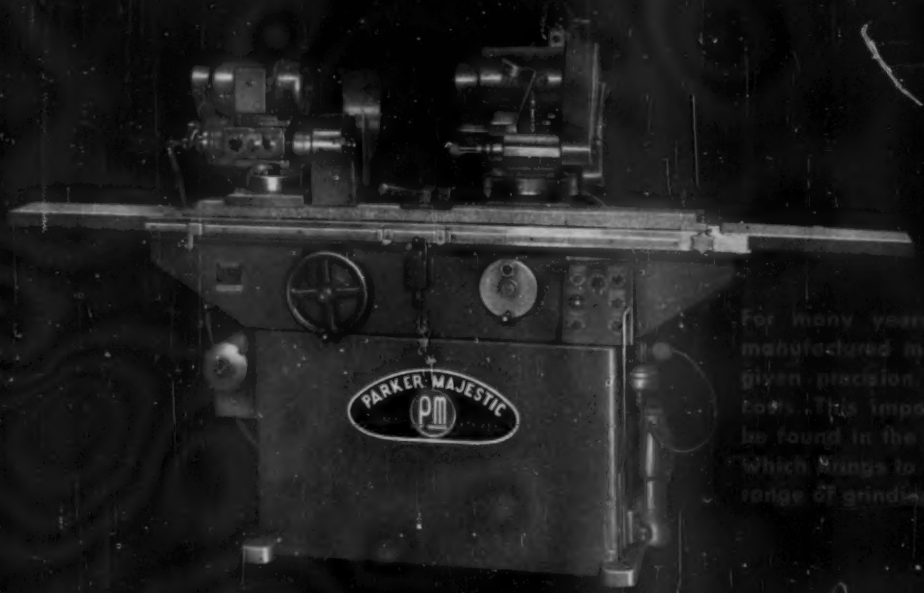
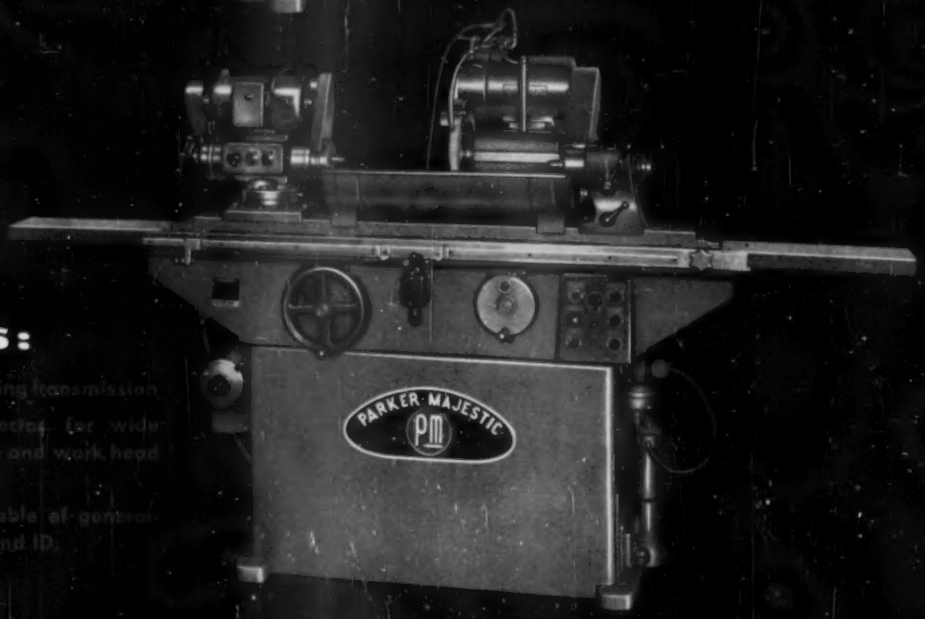
• GREATER IN PERFORMANCE
• LOWER IN COST

THE NEW *Parker Majestic*

No. 2 UNIVERSAL GRINDER



For many years, Parker-Majestic has manufactured machine tools that have given precision performance at lower costs. This important factor will again be found in the new Universal Grinder which brings to industry a much wider range of grinding operations.



FEATURES:

1 Electromagnetic reversing transmission.

2 Dial type speed selector for wide range of table traverse and work head rotational speeds.

3 100% universal. Capable of generating angles, both OD and ID.

PARKER • MAJESTIC PM PRECISION MACHINES

PARKER MAJESTIC, INC. DETROIT 7, MICHIGAN

Threadwell

AND ITS DISTRIBUTORS

INDUSTRIAL DISTRIBUTORS
SERVING INDUSTRY ECONOMICALLY
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ARE READY TO SERVE YOU NOW

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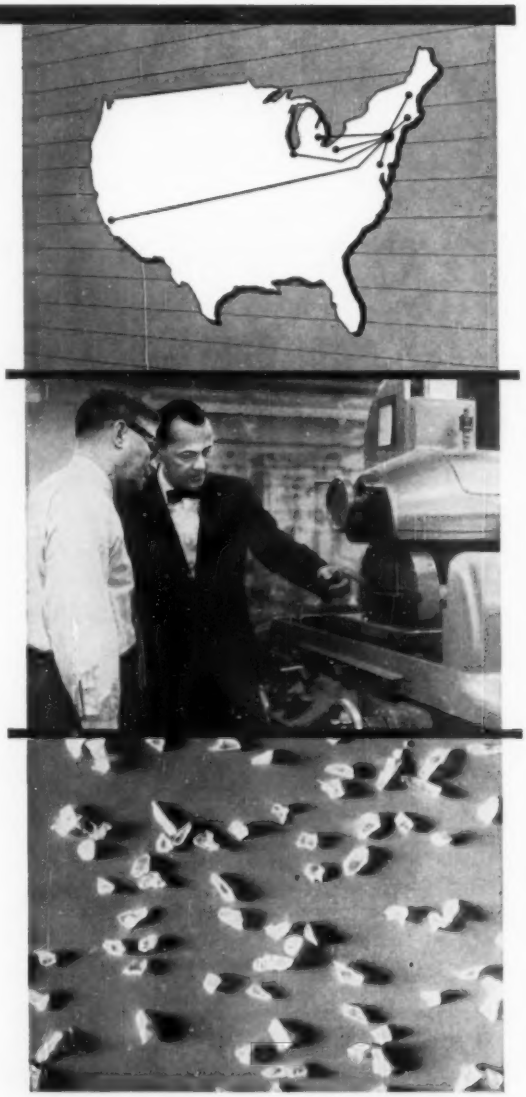
A NEW CUSTOMER-ORIENTED U.S. SOURCE FOR NATURAL DIAMONDS

Six announcements of major importance to users and manufacturers of abrasive products . . . . . >

NOW— a new customer-oriented

1. A new, major U.S. supplier

Engelhard Industries, Inc. announces the establishment of its Industrial Diamond Division—dedicated to the single objective of providing a full complement of technical sales services to purchasers and users of natural industrial diamonds. In addition to technical aids, extensive U. S. inventories, research capability and purchasing assistance, Field Representatives offer their technical services from offices in Boston, Chicago, Cleveland, Detroit, Los Angeles, Newark, New York City and Philadelphia.



2. In-plant technical assistance

This new customer-oriented business is fully prepared to assist you with your abrasives problems. From their locations in key metalworking centers, the Industrial Diamond Division's Field Engineers with their training and experience in *your* kind of tool room and production work are readily available. This "industrial diamond task force" gives in-plant assistance whenever, wherever needed.

3. A new grit for increased wheel life

Performance in the range of 30% longer life for natural diamond resinoid-bonded grinding wheels is made possible by new "SND" (Selected Natural Diamonds) grit. This dramatic development permits constant exposure of only the optimum cutting surfaces in the wheel, and prevents the grit from being prematurely forced out of the bond. Ask your grinding wheel representative about SND-Resinoid natural diamond wheels, or write direct to Engelhard Industries for complete information.

ABOUT ENGELHARD INDUSTRIES . . .

Started in 1889, Engelhard Industries, Inc. is a major American industrial complex serving the world from home offices in Newark, N. J.

Although it is perhaps best recognized in the precious metals field, the Engelhard group produces diverse products for virtually all industries, including metal products manufacturing, iron and steel, aircraft and missiles, electronics, nucleonics, chemical and petroleum production.

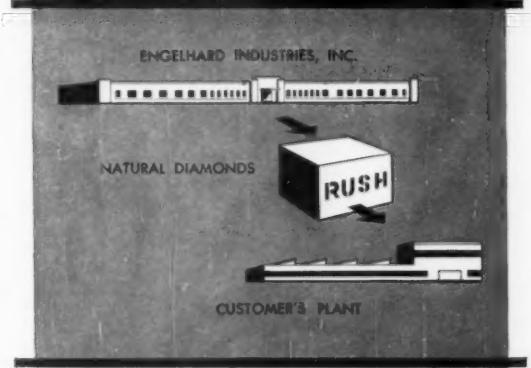
Engelhard Industries' technical interest in the uses of industrial diamonds has developed from its own production testing and engineering investigation to its present widespread activity at the basic research and application levels.

Today, through its new Industrial Diamond Division, Engelhard Industries has combined its experience and facilities in the field of natural diamonds to supply and service the specific requirements of U. S. industry.

U.S. source for natural diamonds

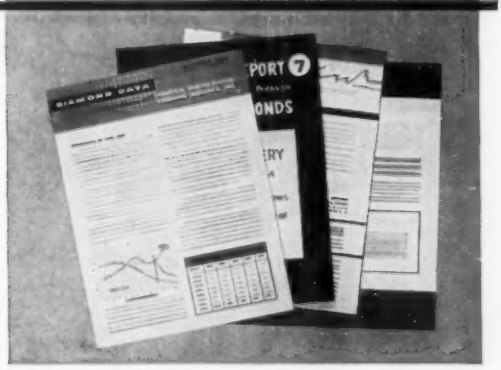
4. 'Diamond Tech Lab'

Experienced metallurgical engineers, tooling and abrasive experts and other specialists staff the newly-formed Diamond Technology Laboratory—a customer service facility in Newark, N. J. Created to solve technical problems in the application of industrial diamonds, the "Diamond Tech Lab" is cooperating with diamond wheel and tool manufacturers, as well as with the end-user of industrial diamond products.



5. 'Off-the-shelf' availability

Engelhard Industries stocks natural diamonds in a complete range of sizes and shapes, in quantities to continually satisfy the needs of American industry. These stocks include fragmented boart, grit (standard, SND-treated or untreated) and larger industrial stones for setting and drilling applications. These stocks will greatly reduce inventory investments, cut delivery cycles and expedite the purchase of industrial diamonds.



6. Technical information service

The Industrial Diamond Division provides a new and complete technical information service to help keep you abreast of the latest developments in diamond products and applications. These new Technical Bulletins will be sent to you without obligation. Simply send us your name, title and company address and we will place your name on our Diamond Technical Bulletin mailing list.

ENGELHARD INDUSTRIES, INC.

INDUSTRIAL DIAMOND DIV.
113 ASTOR STREET • NEWARK 2, N. J.

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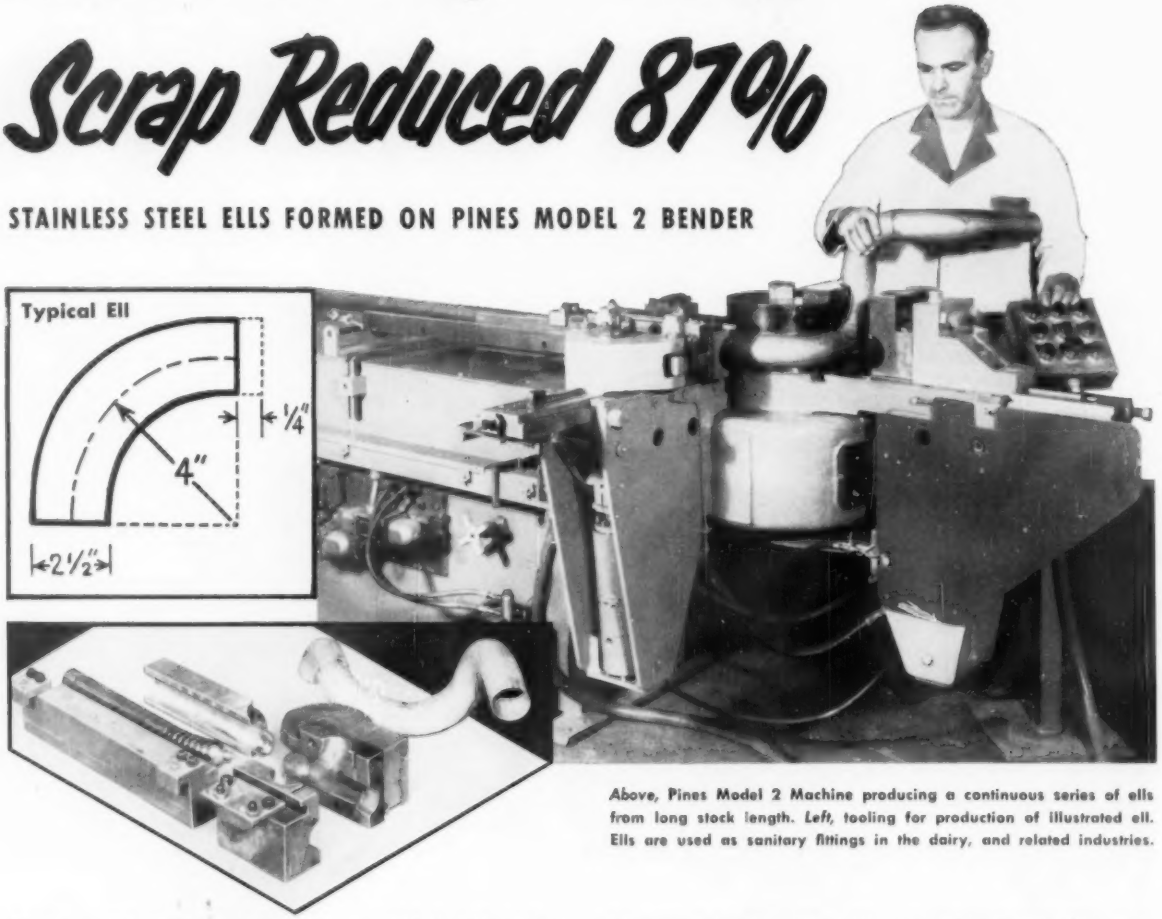
Production Up 400%
Scrap Reduced 87%

STAINLESS STEEL ELLS FORMED ON PINES MODEL 2 BENDER



Above, **Pines Model 2 Machine producing a continuous series of ells from long stock length.** *Left,* **tooling for production of illustrated ell. Ells are used as sanitary fittings in the dairy, and related industries.**

Here's another illustration of how cold bending the "Pines-Way" can increase output and reduce operating expenses. This Pines Model 2 Machine has enabled Alloy Products Corp., Waukesha, Wisconsin, to produce four times more stainless steel ells and cut scrap losses up to 87% over their previous method. Prior to installation of this machine, short lengths of tubing were filled with lead and bent on a press. From 2" to 3" were trimmed from each bend, and production was 30 ells an hour. Today, these bends in Type 304 stainless are produced in sizes from 1½" to 3" O.D., walls of .050" to .065", at an average of 125 an hour. Scrap loss through material trimmed away has been reduced to ¼" per finished piece.

Smooth, Small Radius Ells Produced in Continuous Series

Ells are produced as a continuous series of 90° bends in long stock lengths. All radii are less than 2x tube diameter. For example, 15 ells are bent in a 10 ft. length of 2½" O.D. tubing on a 4" centerline radius. Individual ells are saw cut from the spiral. Only ⅛" of the costly stainless, the width of the saw blade, is lost from each end.

Compound Tooling is Major Factor In Scrap Reduction

Quality, scratch-free bends are produced on tooling that includes compound bending and clamp dies, a mandrel, and a wiper die. A cleat in the horizontal groove of the bending and clamp dies reduces the stock length clamped for the first bend. Succeeding bends are made by clamping on the preceding bend. Call on Pines bending experience and tooling skill for the answers to *your* bending needs.

PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

693 WALNUT • AURORA, ILLINOIS

WRITE FOR *FREE* CASE STUDIES

For further case study reports on the cost-cutting advantages of cold bending, write for free copies of "Pines News." Catalog also available.

PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

BATH Tap'n Gage TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 12

Subject: Acme Screw Threads

Acme screw threads were formulated prior to 1895 and were intended to replace square threads and a variety of threads of other forms used chiefly for the purpose of producing traversing motions on machines, tools and in similar applications. They are now used for many parts in valves, jacks and other mechanisms. The basic characteristic of an acme thread is the 29 degree included thread angle.

General Purpose Acme Thread Classes:

There are three classes of general purpose threads. They are known as 2G, 3G and 4G. Class 2G is the preferable choice for general assemblies. Classes 3G and 4G are provided for cases where less backlash or end play is desired. External threads of any class may be assembled with internal threads of any other class to provide different degrees of backlash or end play.

Centralizing Acme Thread Classes:

There are five classes of centralizing threads. They are known as 2C, 3C, 4C, 5C and 6C. Class 2C provides the maximum backlash or end play. Classes 3C, 4C, 5C and 6C are provided for cases where less backlash or end play is desired. While external and internal threads of the same class are recommended for centralizing assemblies, different amounts of backlash and end play may require interchanging the classes.

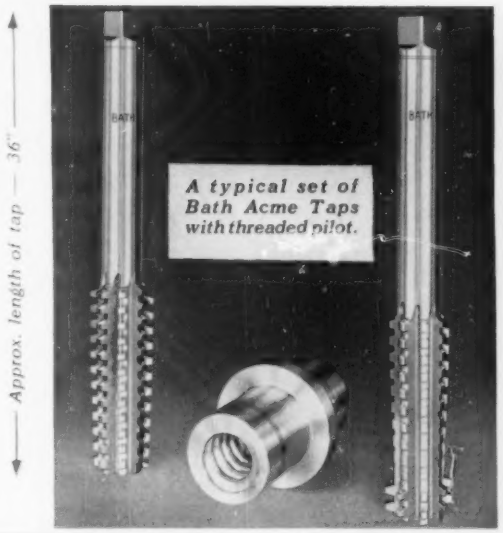
Uses of General Purpose and Centralizing Acmes:

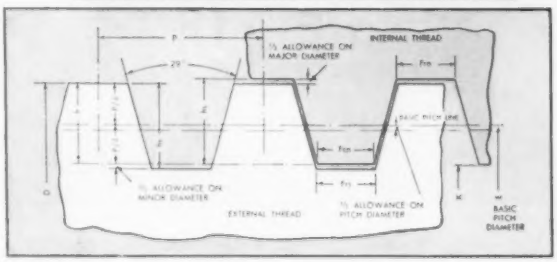
General purpose threads have clearances on all diameters for free movement and may be used in assemblies with the nut rigidly fixed and movement of the screw in a direction perpendicular to the axis limited by the screw bearing or bearings. Centralizing threads have a limited clearance at major diameter of screw and nut so that bearing at major diameter maintains approximate alignment of the thread axis and prevents wedging on the flanks of the thread. In any case sufficient end play must be left to provide a close running fit. Multiple threads should be considered when fast relative motion is required.

Ordering Acme Taps:

The problems involved in tapping acme threads vary greatly and because of this it is very important to supply the tap manufacturer with complete information about the job. In many cases it is necessary to design sets of taps with the style and number dependent on the diameter and pitch, number of pieces to be tapped, surface finish of thread required, material to be tapped, length of thread and other considerations.

When ordering be sure to give: 1. Nominal size and threads per inch. 2. Single, double, triple or quadruple thread. 3. Lead. 4. Right or left hand. 5. Pitch diameter or class of thread. 6. Description of previous taps. 7. Material. 8. Length of nut, opened or closed — and clearance. 9. Diameter of hole before tapping. 10. Type of machine to be used. 11. Are taps to be used for sizing of rough chased threads. 12. Furnish part drawing or sketch. (Upon request, a special form will be provided by Bath for ordering).

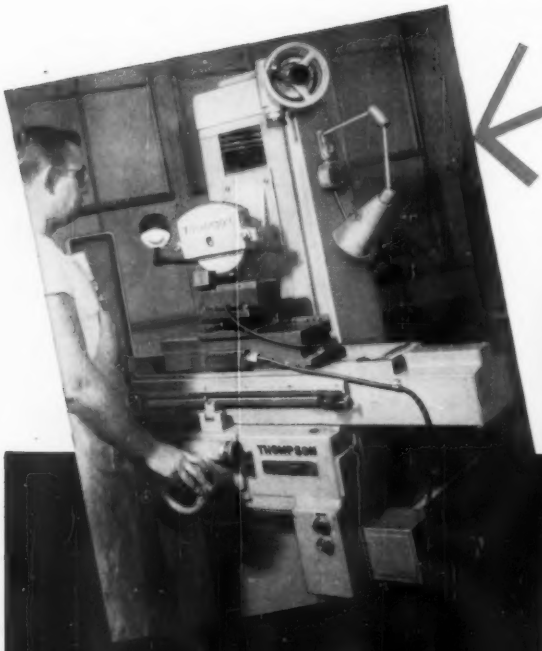




Gaging Acme Threads:

General purpose threads may be adequately gaged by the use of "go" and "not go" plug and ring thread gages representing the product limits. Design should be in accordance with the principle that the "go" gage should check simultaneously as many elements as possible and the "not go" gage can effectively check but one element. Centralizing threads are gaged in the same manner and following the same principles as with general purpose threads except that two "not go" plug gages are required because of the close tolerance major diameter. One gage checks pitch diameter — the other major diameter.

Reference: U.S. Dept. of Commerce Handbook H28, A.S.A. Pamphlet B 1.9



Completely Satisfactory in Every Way

. . . says Mr. William H. Vogt, Division Superintendent of Parts and Tool Manufacturing at Taylor Instrument Companies, Rochester, N. Y.

NEW TYPE D Hand Feed SURFACE GRINDER

is ruggedly designed for precision work.

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95 AMES STREET
ROCHESTER 1, N. Y., U.S.A.
May 7, 1959

Mr. John C. Wilson,
Vice-President, Sales & Engineering
The Thompson Grinder Company
Springfield, Ohio

Subject: THOMPSON Type D Surface Grinder

Dear John:

We have proven the new Thompson Type D Tool Room Grinder by rigid tests in our Tool Grinding Department. We find it completely satisfactory in every way.

We find these decided advantages on the new Thompson:

1. Its ease of adjustment
2. Its ruggedness and rigidity
3. Its bedway and column protection
4. Its large vertical capacity
5. Its cross-feed movement obtained by moving the wheel head rather than using a saddle, which permits accurate grinding of slots.

Everything considered, we find, in our work, the new Thompson Type D a very superior precision machine.

Yours very truly,

William H Vogt

whv:lb

William H. Vogt
Division Superintendent
Parts and Tool Manufacturing

With men like Mr. Vogt, who rate tool room grinders solely on their performance, Thompson's new Type D machine is winning enthusiastic approval.

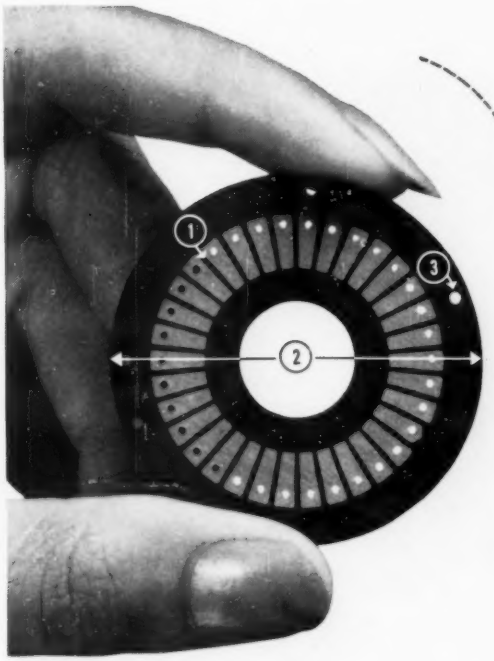
Send for descriptive literature on this new Type D machine and compare the advantages it offers you in cost-cutting time-saving and trouble-free performance. Immediate delivery is available.

"Keep Thompson in mind for that daily grind"

Thompson SURFACE GRINDERS

THE THOMPSON GRINDER CO.

SPRINGFIELD, OHIO



GAGING PROBLEM > KODAK SOLUTION

1. Measure spacing, each to be 10° 35.29′ ± 30″ non-accumulative
2. Measure diameter concentricity, to be within .005", TIR
3. Measure mounting hole locations within ± .003" at diameter and angularly located within ± 30′, non-accumulative

BEST PREVIOUS INSPECTION METHOD

consumed 2 hours per part
(100% *inspection required upon receipt from vendor*)

This case occurred at the Vernistat Division, Perkin-Elmer Corporation, Norwalk, Conn. It involved inspection of a commutator from Perkin-Elmer's Vernistat® A. C. Potentiometer (a device for precisely controlling and regulating voltages in high-accuracy computer, missile and rocket guidance systems). Inspection procedure was by index head for all dimensions.

Not only did such inspection take too much time, but it was not sufficiently accurate.

KODAK CONTOUR PROJECTOR METHOD

inspection rate increases to 100 parts per hour
high inspection accuracy results in vendor quality improvement

The use of a Kodak Contour Projector with a chart-gage at the screen, specially designed for the commutator, increased inspection rates to 100 commutators per hour. Even when a simple grid line chart-gage was originally used, inspection rate was 20-50 parts per 5-hour shift.

Vendor part quality improved, in this case dropping rejection rate to a low 2%. . . a common result when *receiving* inspection is accurate and thorough enough to reveal vendor manufacturing deficiencies.

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The Kodak Contour Projector is distributed nationally through Optical Gaging Products, Inc., 26 Forbes Street, Rochester 11, N. Y.

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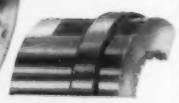

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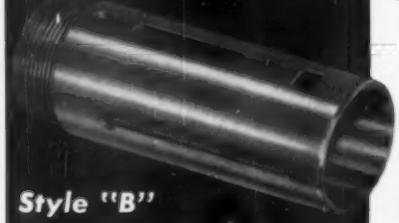

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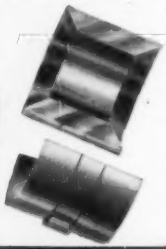

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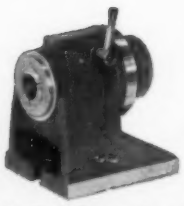
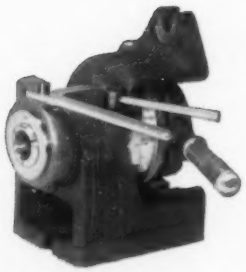


H-4 Tool Room-Inspection



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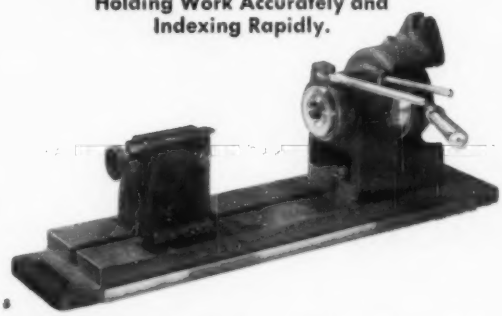

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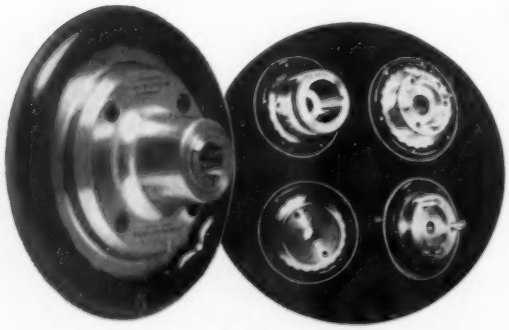

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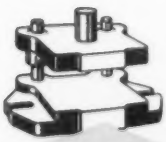

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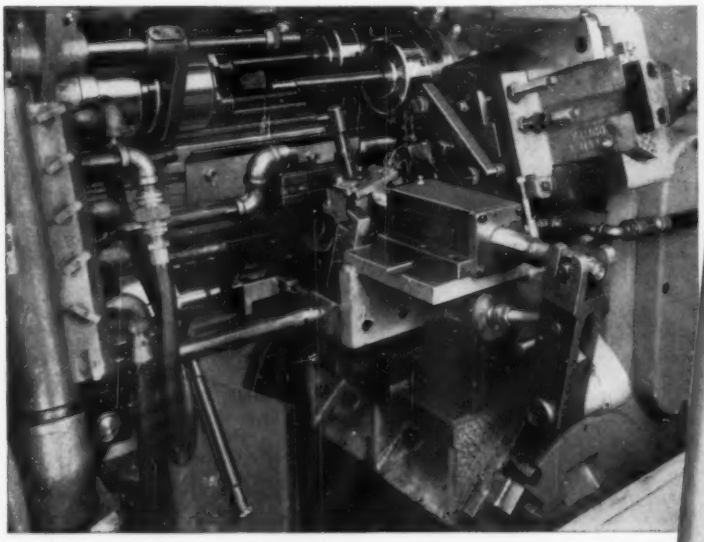

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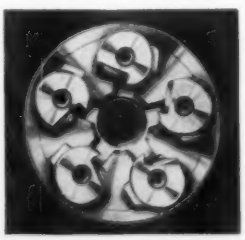

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However, the real lessons to be learned from these tool engineers who have successfuly machined and formed "unworkable" Space Age materials, have found ways to assemble reliable electronic control systems that have hundreds of thousands of component parts—and have been able to keep manufacturing costs down—is that there are no impossibilities in tool engineering. This attitude, more than anything else, has made the Space Age possible. Space Age problems are new, and new approaches are mandatory. But new approaches are equally mandatory in all industries to create greater manufacturing efficiency.

Recently, one of the ASTE past presidents said, "We need . . . the creative approach. We must stop worshipping at the altar of *how* and transfer our allegiance to *why*. We must spend more time thinking about and investigating the fundamental nature and behavior of the materials with which we are working with the object of eliminating work, not just doing it faster."

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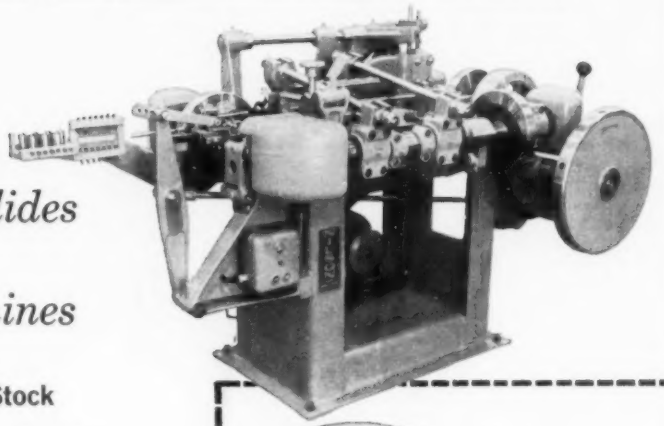

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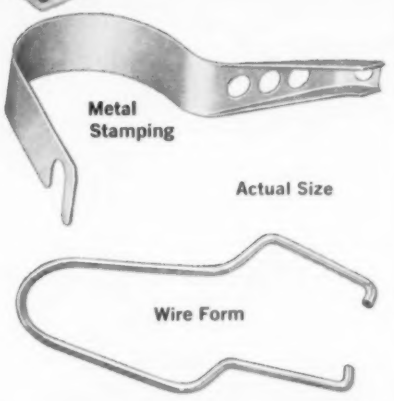

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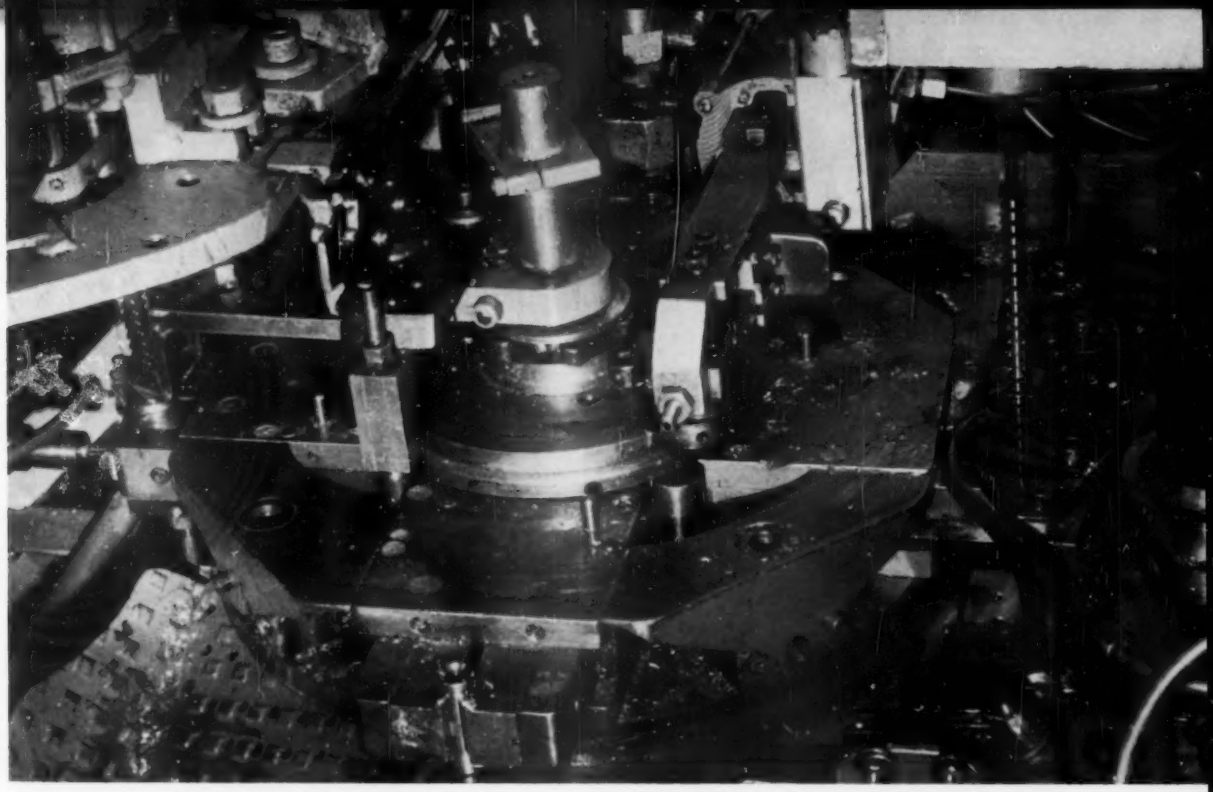


Fig. 1. Special four-station machine broaches, cross drills and taps parts to close tolerances.

Building-Block Automation . . . applied to broaching

By G. Bruce Collins
Erickson Tool Co.
Solon, Ohio

Standard components combined into an ingenious design enabled tool engineers to simplify a broaching operation. Employing one broach instead of three paid dividends in economic operation.

DESIGNED AND BUILT around a standard indexing table, a special machine is performing a broaching job to precision tolerances at the rate of 1100 pieces per hour. In spite of the fact that an expensive indexing machine with three broach heads had been recommended, the Delo Screw Products Co. developed the machine, *Fig.* 1, based upon inexpensive rotary indexer and one 6-inch broach.

This machine performs secondary operations on cylindrical brass brush-holder tubes for electric motors. The part, *Figs.* 2 and 3, as received by the machine, is drilled end to end, grooved, ID chamfered at both ends, and cut to length on an automatic screw machine. Then, the secondary operations which are performed on the special machine involve broaching a rectangular axial hole, cross drilling and cross tapping. The problems associated with the part all concern the broached center hole and its tolerances, *Fig.* 2.

In the special indexing machine, a rectangular broach enlarges this center hole which was drilled while in the automatic to a 0.281-inch diameter. The "impossible" aspects of the job are the fact that the outside diameter must be undistorted by the broach and the hole tolerances must be held to close limits. These dimensions are held to -0.000 + 0.001 inch; concentricity is within 0.005 TIR; the wall thickness left between the corner of the rectangular

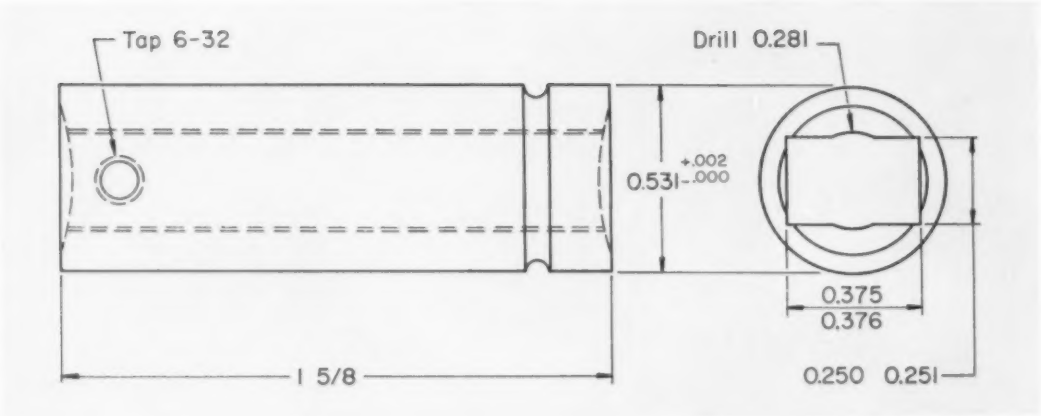


Fig. 2. (above) **Close tolerances and concentricity on the rectangular broached hole demand high indexing and broaching accuracy.**

Fig. 3. (left) **Brass brush-holder tube is broached, drilled, and tapped on the four-station secondary-operations machine.**

broached hole and the outside diameter of the part is only 0.034 to 0.045 inch. In spite of this, the outside diameter must be round within 0.002 inch.

When Delo Screw Products contacted manufacturers of broaching machines and broaches about how to broach the part in one operation, the answer was, "It can't be done." Most of the broaching manufacturers recommended three passes: one to rough the hole, one to bring it nearly to size, and a third to finish. In addition, the broach manufacturers all recommended long broaches.

The company engineers felt, however, that this entire operation could be performed in one pass and still hold the required tolerances. They developed a 6-inch-long broach to perform the operation within tolerance in one pass.

Broach: The 0.001-inch tolerance on the hole is maintained by the broach, *Fig.* 4. It was developed after considerable experimentation with pitch, depth of cut per tooth and the tooth throat design. Since the part is only 1⅝ inch long, the teeth must be fairly close together to give adequate support and eliminate chatter. However, the depth of cut, 0.120 inch on the diagonal, requires considerable throat space. To achieve the required 30-microinch finish, plus close tolerances, the last few teeth must be reserved for finishing. This all adds up to a difficult job to accomplish with a 6-inch-long broach, calling for careful design.

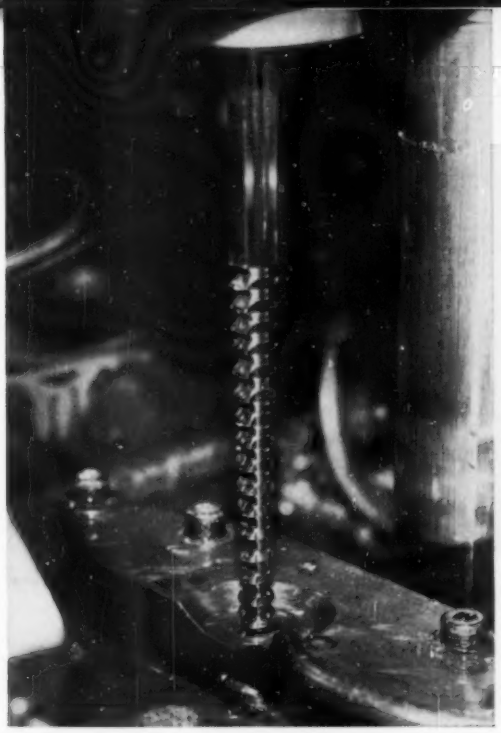
Machine Construction: Designed and developed by Lester Grobe and Fred Pennington of the Delo company, the broaching machine is an assembly of standard units, including an Erickson 400 indexing table and a small hydraulic press. Drilling and tapping heads, air cylinders, valves, and limit switches make up the balance of the machine.

The machine is built around a steel table, *Fig.* 5. On this table is mounted the standard rotary indexing unit. A disk on the table supports four sets of work-clamping arms. These arms are held closed on the work by spring pressure and are opened under action of a cam at the middle of the table.

The rotary table has four stations, the first of which is the load and clamp station. At station 2, to the operator's right, the part is broached. At station 3, a cross drill and chamfer is performed. At station 4, the cross hole is tapped and a rebroach operation accomplished to remove burrs from the drilling and tapping operations, *Fig.* 6. Between stations 4 and 1 the part is unclamped and falls out.

Concentricity of the broached hole is a function of the accuracy of the broach-holding and guiding fixtures as well as the indexing mechanism. The table must index accurately within 0.002 inch to give an equal tolerance for the broach holder.

Distortion of the part is prevented by the specially designed holding fixture which surrounds and clamps the part throughout the entire 360 degrees



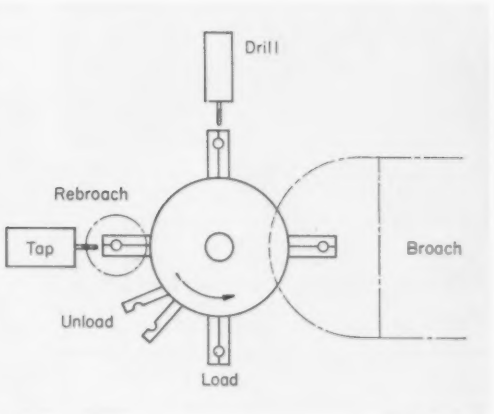


Fig. 4. (left) Broach designed to remove 0.120 inch on the diagonal, yet hold 0.001 tolerances.

Fig. 5. (above) Machine is built around the indexing unit, rotation is anticlockwise. Station 1 (at front) is the load position, station 2 (at right) is broach, 3 is drill, 4 is tap and rebroach. Part drops out between stations 4 and 1.

Fig. 6. (below) After drilling and tapping the cross hole, the center hole is rebroached to remove burrs.

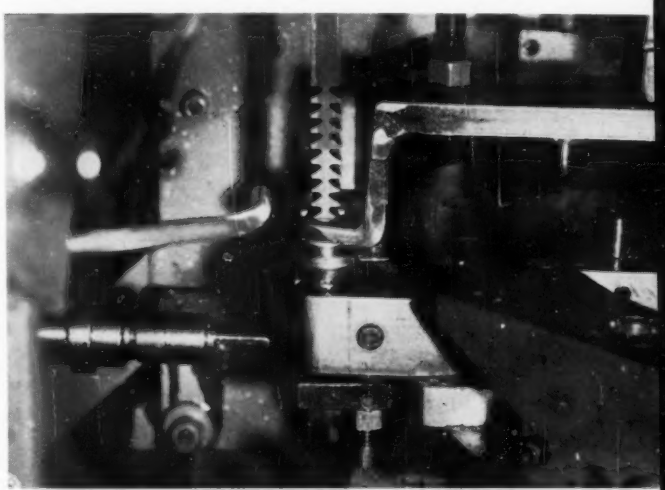
of its circumference. Small spring-loaded balls in the face of the clamp release the part from the holding fixture when it is unclamped.

Operation: The clamping arms remain open until a part is placed between the clamping jaws. This depresses a second switch connected to the same solenoid valve and closes the arm.

After the arm is loaded, if all machining operations are completed and all tools retracted, the table indexes the part to the broaching station. From here it goes to the cross-drill station. The drill is a No. 35; a tolerance of +0.005 is given on axial location. At the third station this hole is tapped No. 6-32 and the rectangular hole is rebroached.

Four vertical pins project from the top of the rotating disk. As the work moves from the last station (the tap and rebroach station) one of the pins strikes a limit switch. The switch is connected to a solenoid valve which controls an air cylinder. The rod of the cylinder is connected to the rotary cam which causes arms to unclamp the work. Only the arm moving between station No. 4 and No. 1 is affected when the pin actuates the limit switch.

Safety Features: All air and hydraulic operations are interlocked by a system of limit switches. These protect the machine against operation if any of the moving parts malfunction during the operating cycle. This is important both to avoid faulty work and to avoid physical damage to the machine because operation of the broaches at the wrong time could do serious damage. In addition, the tap and rebroach tooling would interfere with each other in the hole if both operated at the same time.



Another safety precaution is provided by a probe at station 1, the loading station. This probe is depressed if a part is loaded that hasn't the center hole drilled through. Depressing the probe locks the indexing table and stops the machine. This prevents broach breakage and severe damage to the machine.

An interesting feature of the machine is that the indexing table is operated by hydraulic fluid, supplied from an air cylinder. Air line pressure at 100 psi is applied to one side of the piston and thus to the hydraulic fluid. This in turn supplies sufficient hydraulic pressure to operate the indexing table. After 5 million operations the machine has not required any major maintenance.

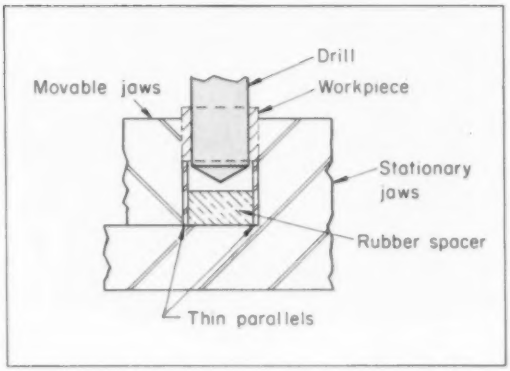
Gadgets

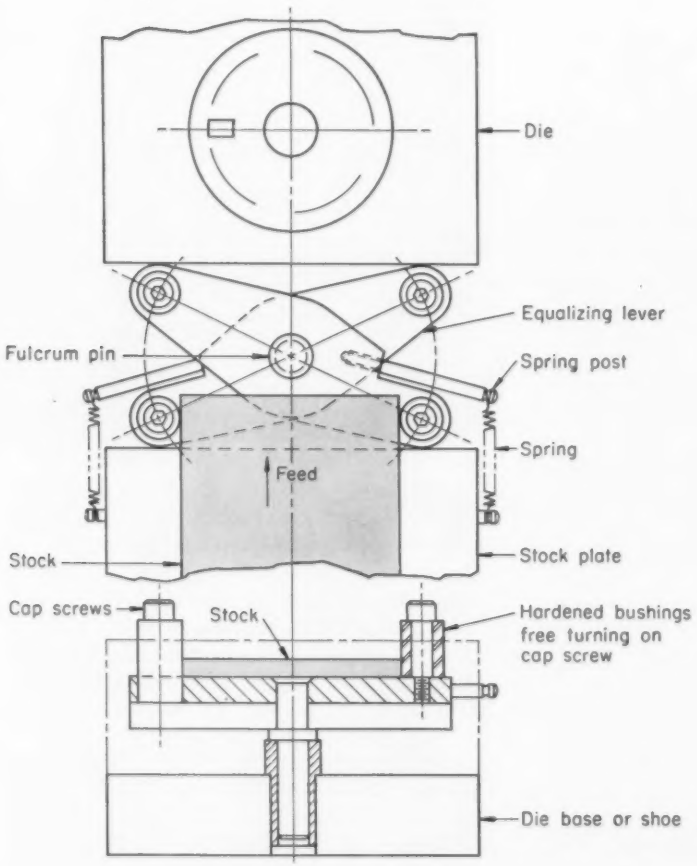
Ingenious Devices And Ideas To Help
The Tool Engineer In His Daily Work

Rubber Spacer Holds Parallels

Thin parallels are often used to support thin-walled workpieces during drilling operations. A typical setup is shown in the accompanying drawing. A good method of keeping the parallels in position is to insert a rubber spacer block between the parallels. An advantage of this method is that when the workholding vise is opened to remove the piece, the rubber spacer keeps the parallels upright. The fact that the drill will not be damaged if it contacts the rubber block is an additional advantage.

A. Anderson, Dayton, Ohio





Stock Guide

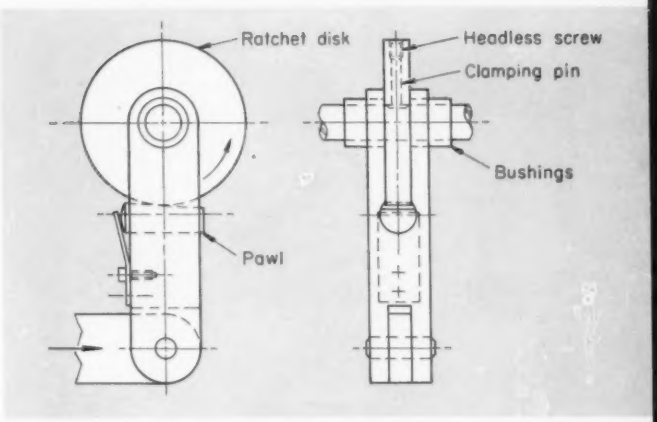
Stock fed into a compound or progressive die is located on the die center line by the scissors type equalizer shown. The equalizer fits between the die and stock plate. The stock is fed through the stock plate until it engages free-running bushings on the equalizer. Pivoting about a fulcrum pin, the equalizing levers center the stock.

Archie Corkigian
Hamilton, Ont.

Ratchet Mechanism

Toothed disks are usually used in indexing ratchets. This is not the case with the ratchet illustrated. In addition to being more easily made than ratchets with toothed disks, the indexing movement can be varied by changing the stroke of the operating link. Engaging the ratchet disk is a cylindrical pin with a flat ground on one side at an angle of six deg. This pin, which acts as a pawl, is a slip fit in the actuating arm. A flat spring keeps the pawl in contact with the disk, which is secured to the shaft with a setscrew and a clamping pin. There is no slippage when indexing.

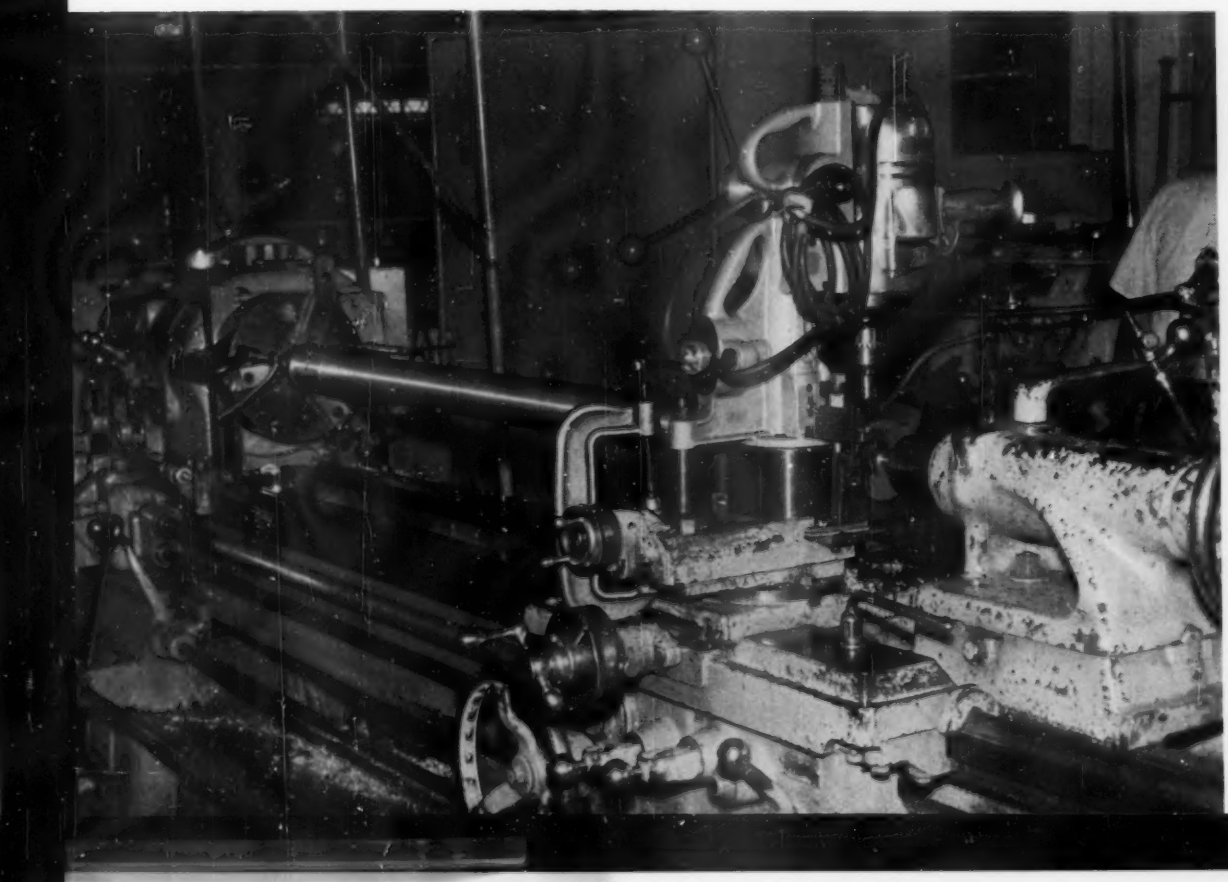
F. Murray, Chicago, Ill.

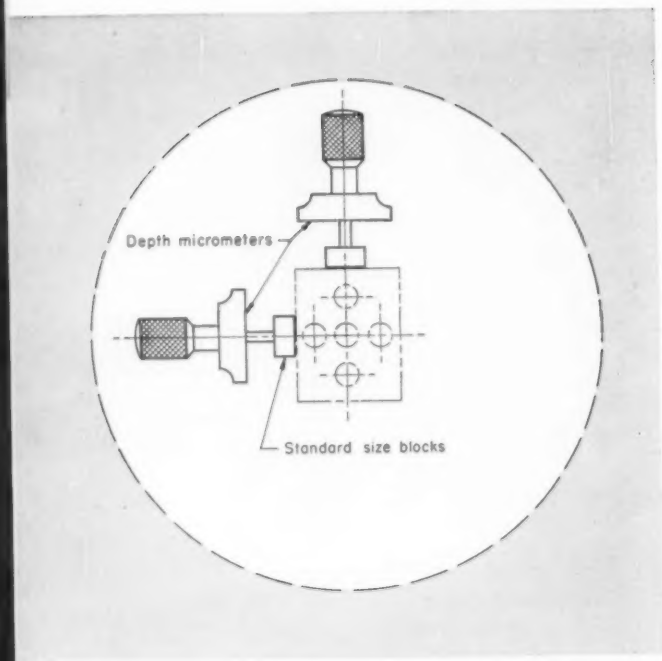


Drilling Method

Long tubes in which a number of holes must be drilled can be processed on an engine lathe in the manner illustrated. The tube is gripped in a three or four-jaw universal chuck and secured at the other end with the tail center. The holes are drilled with a magnetic-base drill press mounted on the lathe carriage. When the pitch of the lead screw of the lathe is equal to an increment of the distance between the holes the spacing of the holes is performed by engaging the half nut in the lead screw. When all holes have been drilled in one line, the lathe chuck is indexed to the proper angle to drill other holes at radial angles to the first set. Scribed lines on the chuck provide location of position.

Edward W. Grayson
Baltimore Chapter

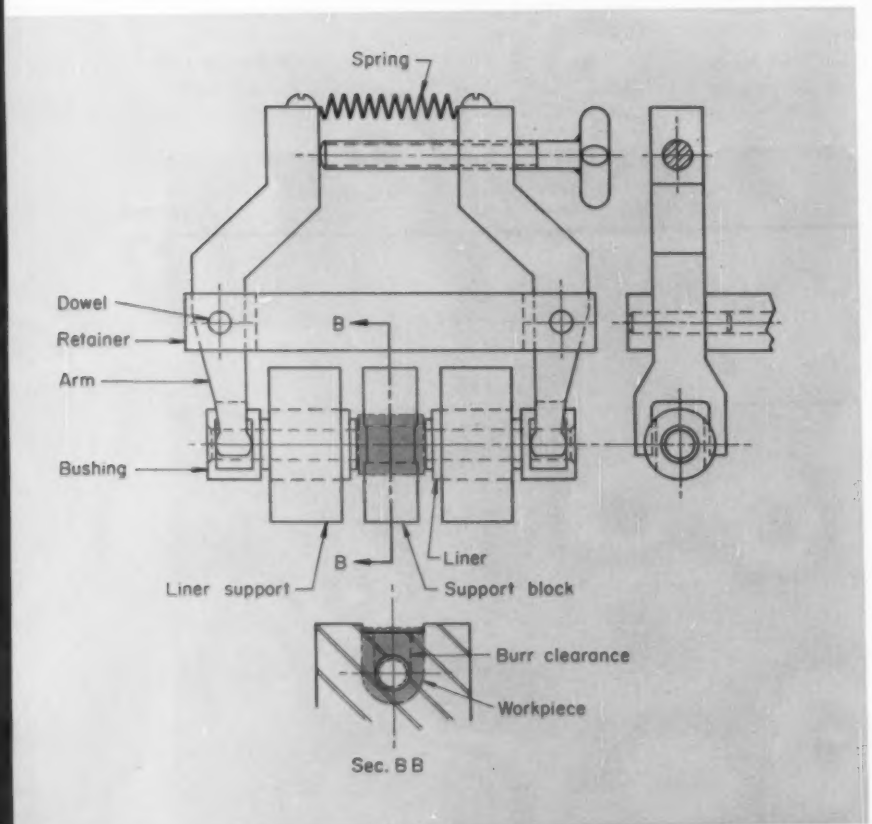




Hole Spacing Method

Shown on the accompanying sketch is a method of accurately spacing holes that are to be bored in a square workpiece. The workpiece is clamped onto the faceplate of the lathe and the first hole to be bored is located and bored to size. Two depth micrometers are clamped at right angles to each other, as shown, on the faceplate. Size blocks are placed between the micrometers and the workpiece after a reading has been set. The depth "mikes" are then backed off the required distance between the next hole to be bored in the workpiece and the hole first bored. The workpiece is then shifted. The size blocks can be omitted, but a truer setting is usually obtained with them. The workpiece is then clamped in position and the next hole is bored. This operation is performed each time a new hole is bored. The depth mikes should of course be taken from the faceplate of the lathe before starting the machine. For best results, the workpiece should have at least two sides at right angles to each other.

Frank L. Rush, Columbus, Ohio



Combination Clamp

Small yoke-shaped parts can be drilled easily with the combination clamp and drill bushing shown. The workpiece is nested in a support block that has burr clearance on each side to provide easy part removal.

Bushing heads are milled to accommodate ball-end clamp arms. When the handle is turned, the bushings move inward and clamp the workpiece with equal pressure on both sides.

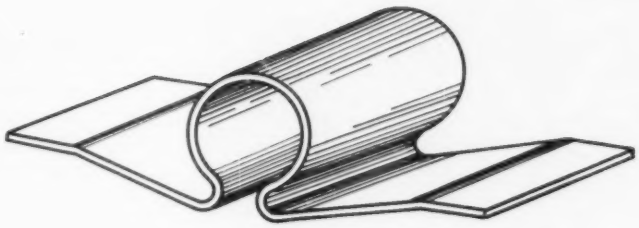
F. A. Adams
Dayton, Ohio

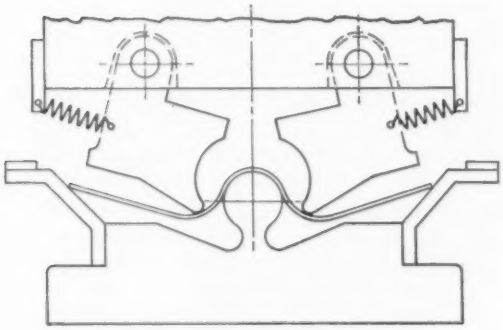
Gadgets

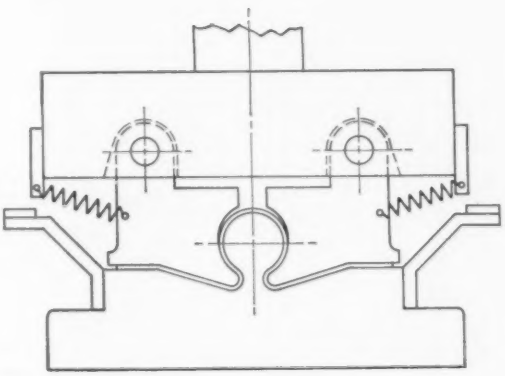
Forming and Bending Die

Illustrated is a practical method for forming and bending the part shown. The workpiece is located between two stop plates. When the press ram begins the downward stroke, the piece is bent over the forming die. As the forming blocks contact the two beveled surfaces they are forced together against the forming die and the part is finished.

Hjalmar Dahl
Upplands Vasby, Sweden



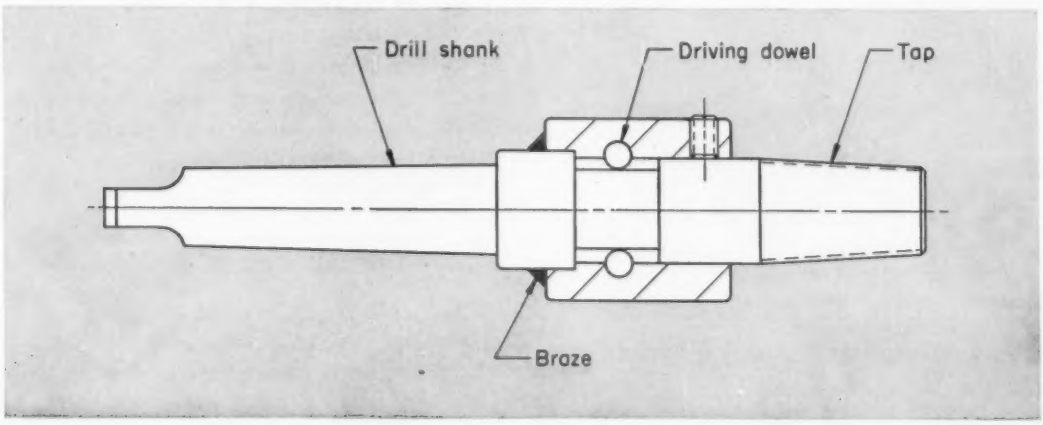




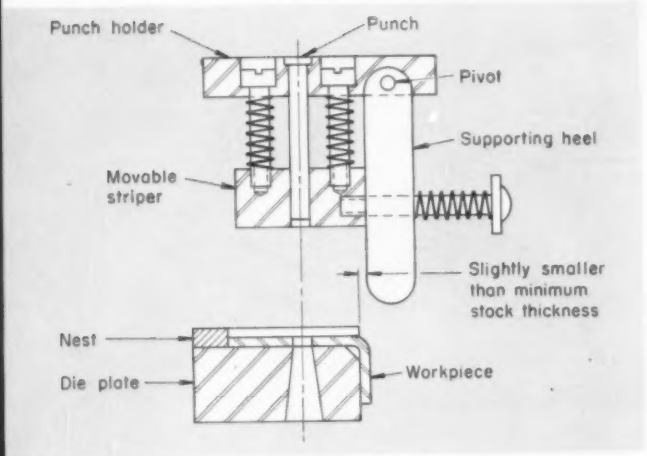
Tap Holder

An easily made emergency holder for large special-size taps can be made as illustrated. The shank of a broken twist drill is ground square with the axis on the stub end. A round piece of cold rolled steel is bored to a slip fit with the tap shank. One end is counterbored to a good fit over the stub end of the drill. The two units are carefully welded or brazed together. Dowel pins engage the flat of the tap for driving purposes. A setscrew prevents the tap from pulling out of the driver when reversing.

Roger Isetts
Kenosha, Wis.



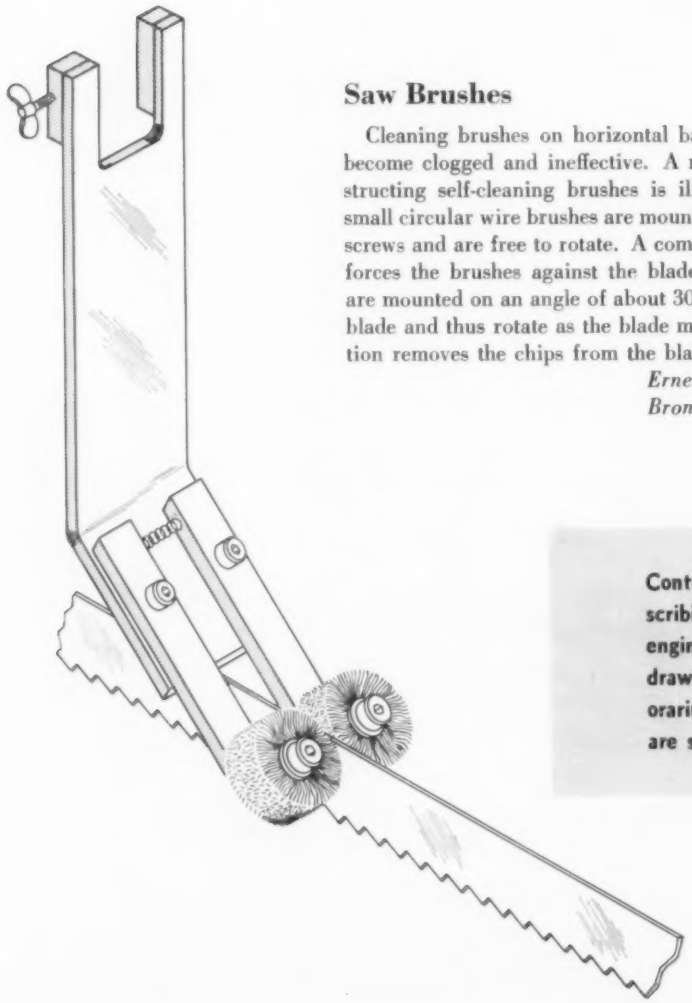
Gadgets



Punching Tool

Illustrated is a punching tool that accurately punches a hole positioned from a 90-deg angle bend in formed sheet metal. The bent component is placed on the die and positioned in a nest. A supporting heel pivoting in the punch plate contacts the part when the ram descends. This heel holds the workpiece firmly in place while the hole is punched. Any variations in stock thickness are automatically compensated for.

Federico Strasser, Santiago de Chile



Saw Brushes

Cleaning brushes on horizontal band saws often become clogged and ineffective. A method of constructing self-cleaning brushes is illustrated. Two small circular wire brushes are mounted on shoulder screws and are free to rotate. A compression spring forces the brushes against the blade. The brushes are mounted on an angle of about 30 deg to the saw blade and thus rotate as the blade moves. This motion removes the chips from the blade.

Ernest Jones
Bronx, New York

Contributions for these pages describing short cuts for the tool engineer are welcome. Finished drawings are not necessary. Honorariums for accepted articles are sent upon publication.

direct MEASUREMENT of taper

By George Gershman*
Taper Micrometer Corp.
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With the development of a new measuring instrument, it is possible to inspect tapered parts 10 times faster than with conventional methods. Both internal and external taper can be checked without the need for sine bars or other elaborate equipment.

MACHINING OF ACCURATE TAPERS with the aid of long-established gaging methods is frequently time-consuming, requiring costly gaging equipment and mathematical skill. A typical setup may involve a precision surface plate, gage blocks, sine bar, height gage and dial indicator. More important, however, is the necessity of removing the tapered workpiece from the lathe or grinding machine in order to measure the taper.

If, as often happens, the taper does not fall within the specified limits, it is necessary to replace the work in the machine and to adjust the latter by the amount the taper is in error. Since the work can rarely be replaced in exactly its previous position on the centers, the adjustment of the machine may now be incorrect and it may be necessary to remove and replace the work a number of times before the desired taper is achieved.

The taper micrometer has made it possible to measure taper directly and rapidly with a single piece of relatively inexpensive equipment and without the necessity of removing the work from the machine. This micrometer, incorporating within itself the sine-bar principle, gives the actual value of the taper for small angles. Larger tapers can be obtained from the micrometer readings with no more mathematical knowledge than is needed for converting from included angle to taper. Under production conditions, of course, the desired upper and lower limits for the various tapers to be produced can be readily specified in terms of precise micrometer readings.

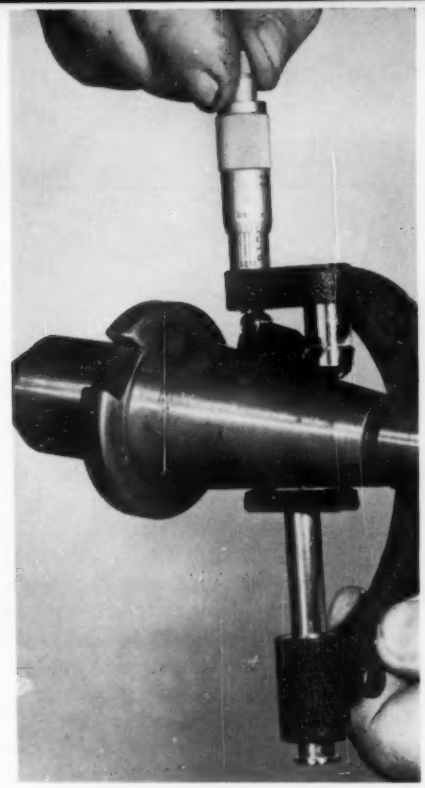

Fig. 1. Direct measurement of taper is made possible by incorporating a sine bar in a micrometer. This speeds inspection.

Principles: The principle of the taper micrometer is illustrated in *Fig.* 1. Attached to the micrometer spindle is an extremely accurate one-inch sine bar which pivots on a post fixed to the frame. The anvil is adjustable to permit a range of work sizes to be measured. The total spindle movement on a standard OD taper micrometer is 0.300 inch, corresponding to an included angle of 17 deg, 27 min.

The taper can be obtained with the same accuracy as the micrometer can be read. Temperature changes do not affect the accuracy since the only distances entering into the determination of taper are those associated with the sine bar and the spindle. As long as these two elements are at the same temperature, the relationship between the included angle and the micrometer measurement will be independent of temperature.

Exact relationships between the included taper

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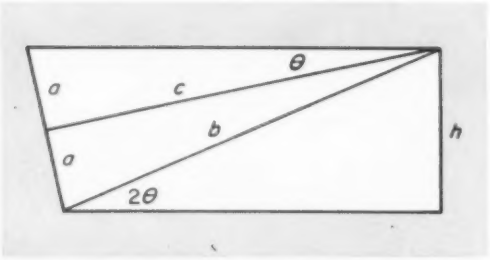


Fig. 2. Geometrical basis for taper measurements.

t, the included angle 2θ, the micrometer measurement h and the sine-bar length b can be readily derived from *Fig.* 2. Here $h = b \sin 2\theta$, and since $t = 2a/c$ by definition, $t = 2 \tan \theta$. The included taper can be calculated from the micrometer reading, or vice versa, with a table of sines and tangents.

It is also possible to eliminate the angle from the two equations and express h directly in terms of t. This is advantageous in setting up tables of t versus h. Starting with $h = b \sin 2\theta$, $h = 2b \sin \theta \cos \theta = bt \cos^2 \theta = bt\ (1 - \sin \theta \cos \theta \tan \theta) = bt\ (1 - ht/4b$, so that $h = 4bt/(4+t^2)$. This gives the micrometer reading as a function of the included taper.

The last equation can be solved for t and expressed in the following power series:

$$t = \frac{h}{b}\left(1 + \frac{h^2}{4b^2} + \frac{h^4}{8b^4} + \frac{5h^6}{64b^6} + \ldots\right)$$

The principal value of this equation is that is shows directly that for a one-inch sine bar ($b = 1$), t is equal to h when the latter is sufficiently small. As h becomes larger, t begins to exceed h, at first slowly, then progressively more rapidly, as indicated by the following tabulation:

h, inch	$t - h$, inch
0.0740	0.00010
0.1000	0.00025
0.2000	0.0021
0.3000	0.0072

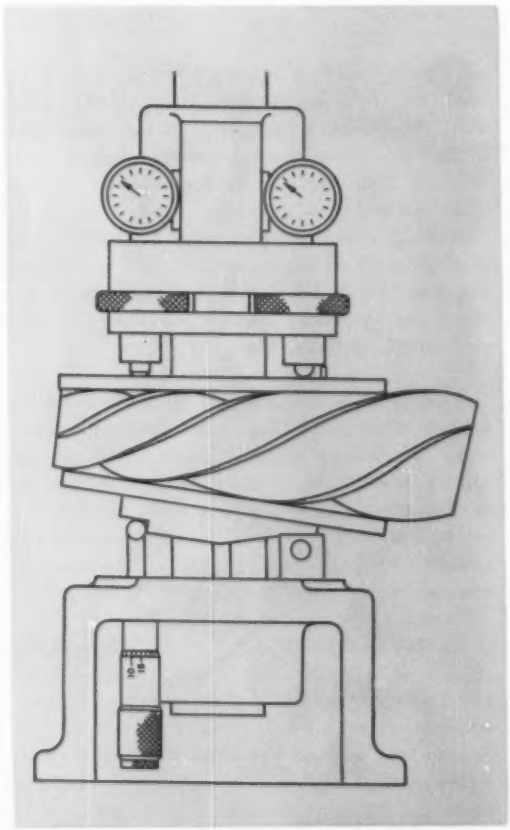


Fig. 3. Bench model micrometer used for inspection of tapered spiral reamers.

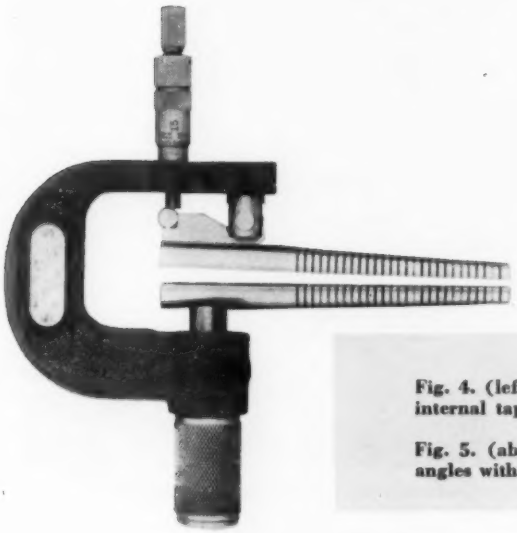
Special-Purpose Micrometers: Although the one-inch sine bar is ample for most measurements, large taper micrometers are provided with longer sine bars, up to three inches in length, for convenience in holding the micrometer against the work. Taper micrometers to handle parts up to 38 inches in diameter have been built.

Extremely small parts, such as tapered pins for the watch and instrument industries, which might be only 0.050 inch in diameter and 0.25 inch long, can be readily measured with a special micrometer having serrated jaws.

A bench model is useful in the inspection department for rapid inspection of tapered parts. A special version, illustrated in *Fig.* 3, makes it possible to measure tapered spiral reamers with high accuracy and a minimum of effort. The dial gages on top are used for adjusting the top plate so that the micrometer attached to the sine bar reads zero when the bottom plate is in contact with the top one. Similar flat plates can be attached to the hand model of the taper micrometer. This permits the taper to be measured while the reamer is still on the grinding machine.

Internal taper can be readily measured to a high degree of accuracy by means of a modification of the external micrometer, such as is shown in *Fig.* 4. The straightness of the tapered hole is easily checked by applying diemaker's blue to the probes and examining them for completeness of contact. Holes as small as 0.2 inch in diameter can be measured. The sine-bar principle can also be applied as in *Fig.* 5 to the direct measurement of dovetail angles, thus solving a difficult inspection problem.

Economic Advantages: One great advantage of a taper micrometer over conventional equipment is the time that can be saved. For example, to grind a 0.060-inch included taper under production conditions on a 6 inch long, ¾-inch diameter tapered lap required 30 minutes when a sine-bar was used,



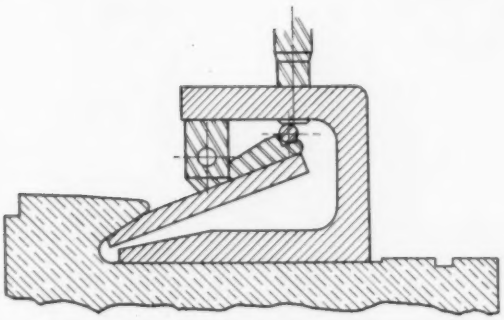


Fig. 4. (left) Modified external micrometer for measuring internal taper.

Fig. 5. (above) Setup for direct measurement of dovetail angles with taper micrometer.

but only three minutes with a taper micrometer, since the latter was used without taking the lap out of the grinding machine.

Similar savings have been realized in connection with extremely large parts such as rolling-mill bearings, where tapered journal ends as large as 20 inches in diameter have to be reground. It took 12 to 16 hours to grind and then gage one end of a journal with ring gages weighing up to two tons, but only four hours when a 22-inch taper micrometer weighing 2½ lb was used. Not only was the time reduced greatly, but it was no longer necessary to tie up the crane needed to handle the heavy and expensive ring gages.

Another instance in which there was a great saving in both time and equipment cost involved the manufacture of tapered spiral reamers. Groups of reamers were taper ground and sent to another building for inspection on a $10,000 piece of optical equipment, and then they were returned the following day for the taper to be reground as necessary. All this delay and handling were eliminated by placing a $350 bench-model taper micrometer next to the grinding machine, and it became possible to take two men off this job.

An interesting application of the internal taper micrometer is for determining the internal taper on the spindles of machine tools that are being rebuilt. Not only is the taper determined immediately and accurately, but there is no longer need for a large assortment of tapered plug gages.

Another advantage of the taper micrometer over conventional equipment is that taper cannot be determined accurately if any dirt is accidentally left on any of the contacting surfaces. It is obvious that it takes far less time to thoroughly clean the areas in which the work and taper micrometer are in contact than the much larger and more numerous areas associated with a sine-bar setup.

To summarize, a taper micrometer is not only inherently a highly accurate measuring device, the use of which requires little training, but it also results in great savings with respect to both equipment costs and manpower utilization.

Beryllium Fasteners Beat Gravity

MISSILE AND SATELLITE FASTENERS made from beryllium will be produced in a new exotic metals facility just opened by Standard Pressed Steel Co. The $100,000 pilot plant operation will fabricate beryllium, which is one-fourth the weight of steel and more costly than gold, into threaded parts.

Less than half the weight of titanium and only 70 percent that of aluminum, beryllium surpasses even these materials on a strength per pound basis.

A beryllium bolt that can support a load of 125,000 psi is, on a strength-to-weight basis, the equivalent of a steel bolt with 500,000-psi tensile strength. But the strongest steel bolts made today are rated at only 260,000 psi. Thus, potentially, one pound of beryllium bolts can do the job of two pounds of the strongest steel bolts.

Since beryllium is exceptionally notch-sensitive, its full strength potential is not yet realized in parts with notches such as threads or bolt heads. Work is being done to solve this problem.

Fig. 1. Checking a tape-controlled machine reproduction of a third-degree formula.

programming for Contour Milling

By Frank A. Twitchell*
Sr. Design Engineer
Norair, Div. of Northrop Corp.
Hawthorne, Calif.

Careful planning for drafting and programming for numerical control of milling machines can result in markedly increased savings. Such a system at Norair is described together with interesting and outstanding applications.

NUMERICAL CONTROL by its very nature is a systematic process and requires an orderly effort to achieve the economic and accuracy advantages that are possible through its use. Drafting and programming are basic operations for numerical control. These operations translate part dimensions and tolerances, cutter shape and size, cutting paths and sequences, and other data into numbers or codes representing numbers. Then, computation and interpolation converts the data into a form suitable to control milling machine operations.

With the converted data recorded on tape or another suitable control medium, it is possible to machine one or more parts with simplified workholders, *Fig.* 1, at nearly the same speed per part as if that part were one of hundreds made in a single production run on an automatic machine.

When numerically controlled machines are used, an entirely new concept in drafting procedure may be justified. It will be necessary, however, to evaluate the need for and the desirability of producing parts with automatically controlled machine tools. Where numerically controlled machines can be employed effectively in production, considerable savings may be realized.

Programmed machine control data may be provided either in the initial drawing produced by engineering or tool drawings made for subsequent tool design planning. In any event coordination between engineering, manufacturing and planning must be on a cooperative basis.

For numerically controlled machine tools, the Aircraft Industries Assn. has defined four classes of tape controls for machine tools. These are:

1. Class I—Tape Template: In this contol, a given physical dimension on the tape is equal to or proportional to a dimension on the part. It is the utilization of an equivalent to a rolled-up template. This

*Senior member ASTE Centinela Valley chapter.

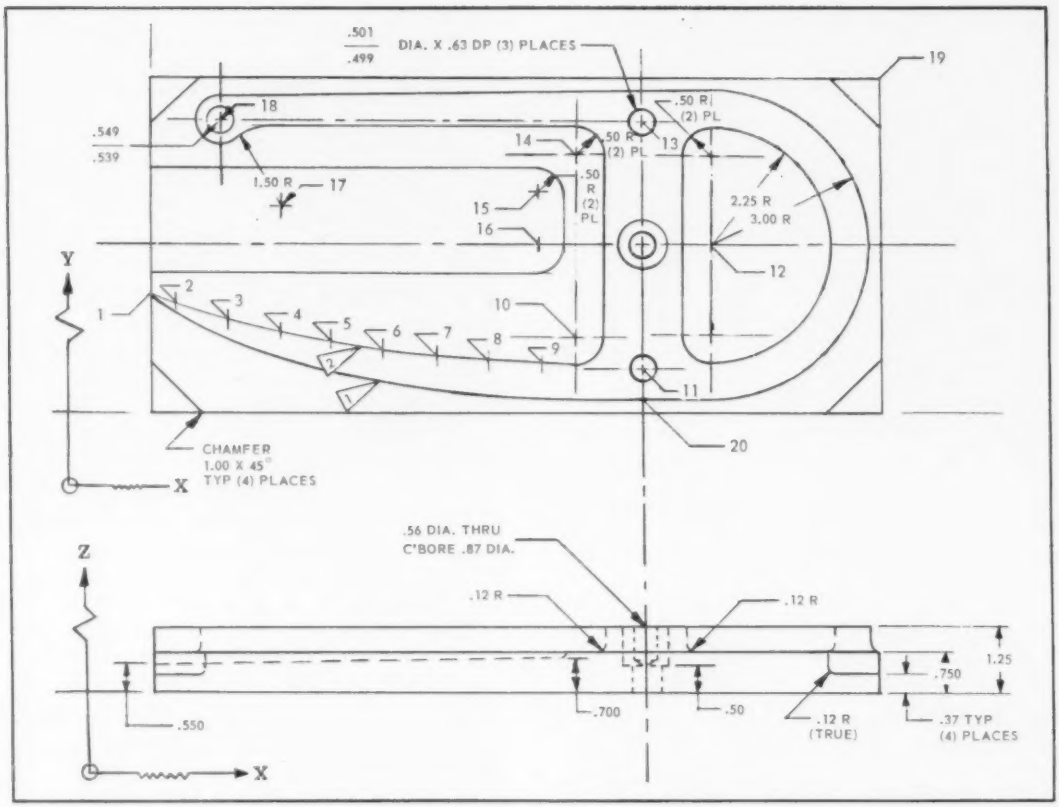


Fig. 2. Two-view orthographic projection of part, showing dimensioning points for programming.

control can describe either one or two dimensions. Example: a riveter or drill press

2. Class II—Cycle Programmer: Tape is substituted for electrical or mechanical cycling devices, either simple or extremely complex, in this control. This class may control machinery, index the tools, activate clamps, etc. Example: lathes, stretch presses
3. Class III—Point-to-Point Locators: This tape control guides the spindle to a numerically defined point, usually described in only two axes, and then cycles the operation. The path from one defined point to another is not controlled. Example: turret drill press, boring mill, hole spacers, etc.
4. Class IV—Continuous Path Control: In this type of control, the path of the working tool is continuously controlled in at least two out of the three axes and may be controlled in three, five or more axes. Contours and complex curves can be produced by this method. Example: profilers, skin mills, spar mills.

In a contouring system, programming, computing and interpolating are preparatory functions for automatically controlling machining operations. Programming involves numerical definitions of the part to be cut and of the machining operations to be performed. Then computing transforms these definitions to give necessary data for the tool center path, factoring into the calculations the shape and size of the tool and the desired part accuracy. Where required, interpolating is used to expand the computed data into continuous positioning information. These data are used to provide continuous control of the machine tool and automatic operation of each controlled machine feed in accordance with the continuous positioning information supplied to the control from the punched tape.

Information for Drawings

Drawings, prepared primarily for parts to be produced on 3-axis numerically controlled machines, should preferably be a two-view orthographic projection. The principal view normally shows the profile or plan view surface to be numerically machined, *Fig.* 2. The designer determines the number of points to be used in conjunction with the tool planner. Quantity of points need only be sufficient to completely define the part. Usually, a numbered point is required where a change of direction of a line or surface occurs. This is not unlike dimensional requirements of the conventional drawing system. In any event, the first consideration of the designer is the functional integrity of the part. Suitable dimensioning for this purpose will supply sufficient surface control for numerical planning.

Drawings prepared initially for numerical control programming need be extremely accurate only when

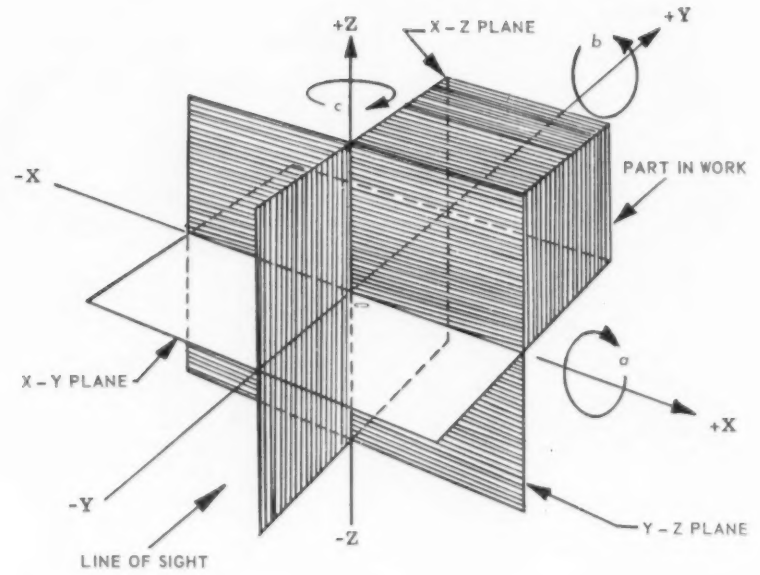


Fig. 3. Representation of linear axes and location of workpiece in positive quadrant. Angular rotation of axes is shown by *a*, *b* and *c*.

a system is used whereby information on the drawing is transferred directly to tape. Glass cloth might be used in such an application. Conventional vellum drawings, however, are sufficiently accurate to check point coordinates and functional accuracy of a given design.

The other machine motions requiring description are the simple angular rotation and compound angular (tilt) motions. Simple angular rotation corresponds to the angles *a*, *b* and *c*, *Fig.* 3. Each is a rotation about the linear axes X, Y or Z, respectively. Also, each is generated in a clockwise direction when looking in the plus direction down the corresponding X, Y or Z axis, *Fig.* 4.

Such angular rotation positions the spindle axis so that it is no longer an X, Y or Z direction. In these cases, the angular spindle axis is labeled the P axis, *Fig.* 4.

This is also the case when compound angular positioning takes place. Compound angular rotation of the spindle axis is defined by angles *d*, *e* and *f*, *Fig.* 4. These are thought of as taking place after one of the simple angular rotational motions *a*, *b* or *c* has been accomplished.

Point Locations

Engineering data to code a part drawing for processing involve:

1. Straight lines: To identify a straight line it is necessary to determine the coordinates of the end points
2. Arcs of circle: End points of straight lines intersected by arcs as well as centers and radii are required to define circular arcs
3. Other defined curves: End points, centers and applicable equations are needed to identify sections of ellipses, parabolas, etc.
4. Nondefined curves: Set of points in space of sufficient magnitude for desired accuracy is required to describe a smooth surface

Radii used for cutters, etc., should utilize a standard tool size whenever possible and be kept uniform throughout the part where practical. This is desirable because the tape or control medium is developed automatically from established drawing location points plus an automatic compensation for the cutter size setback.

Curved surfaces that are not functional should tend toward simplicity rather than complexity. For example, elliptical curves may be plotted with equations. Perhaps constant radii and center coordinates can be utilized. The draftsman need only specify the equation and the end points.

Consideration should be given at this point to the drawing for numerical control of parts which have subsequent operations and are capable of being machined with the original fixture and setup. This would be accomplished by interrupted tape or control medium programming such as at a cutter change point or part reorientation.

Machine Axes Designations

The linear axes of a conventional system are X, Y and Z, *Fig.* 3. They are always stated in alphabetical order. When the axis has been oriented and the X-Y plane established with relation to the machine tool, the rest of the geometry falls into place. Usually, the X axis is considered the first and basic reference axis.

The workpiece is decimally dimensioned to reference locations. These dimensions are shown by coordinates of the points, reference to a datum or

point common to all axes, which is chosen on an extremity or outside the part. The part is always shown in the positive quadrant. Assignment of the secondary horizontal cross-slide motion as the Y axis fixes the X-Y plane. The Z axis is perpendicular to this X-Y plane.

The axes for defining these curves are identified as follows:

X = Longitudinal axis left to right
Y = Lateral axis front to back and
Z = Vertical axis from bottom to top (depth)

Specific tolerances which are different from the established title block tolerances should be shown decimally in a manner to coincide with the specific reference points involved. Such a tabulation is shown in *Fig.* 5 for points identified in *Fig.* 2. Recommended methods for dimensioning intersections of curves and lines are shown in *Fig.* 6.

Location points coordinated to a datum or point common to all axes on an extremity of the part provides realistic dimensioning when the numerical machine control drawing is to be utilized as a conventional vendor, machine shop, or inspection drawing. However, when being programmed for numerical control it has the following disadvantages:

1. Programmed points need a cutter center or face off the working surface available before the machine operation begins and after machine cutter change
2. Programming must offset for the cutter radius
3. Programming must offset for cutter width when circular side milling cutters are applied to parts with grooves, channel cuts and T-slots.

Because the part to be produced is usually shown in the positive quadrant, all coordinate values are planned to be positive. This reduces the amount of error due to misused positive or negative values in programming. However, such errors will normally be detected when setting up a program. Parts and operations can be programmed to zero at the end of the run as a program and operation check.

Advantages of Automatic Machine Control

Numerically controlled milling is a useful and economical method for producing many parts, either simple or complex, and has the following advantages over conventional milling:

1. Lead time is reduced. Tape can be produced faster than models or cams
2. Tooling costs are reduced through the elimination of auxiliary tools such as cams and templates
3. Weight savings in parts can be effected by designing and dimensioning to minimum tolerances due to the intrinsic accuracy of the system
4. Skills of qualified engineers who prepare the tape are reflected in the part and in no way can be altered by the operator
5. Part scrappage due to random errors is reduced, since each part is produced in a given lot in exact sequence on the same equipment

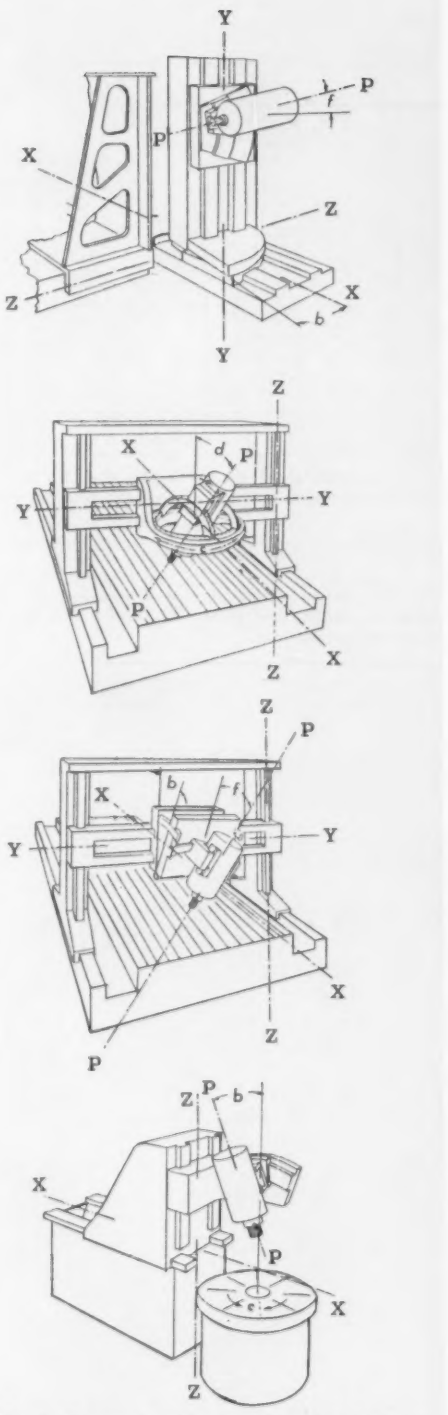


Fig. 4. Conventional axes *X*, *Y* and *Z* shown as primary machine motions. Corresponding axis rotations are indicated as *a*, *b* or *c*, respectively. Machine spindle axis, angularly positioned, is labeled *P* axis.

Coordinates and Tolerance Limits for Critical Points

POINT	X	TOL.	Y	TOL.
1	0.000	±.010	2.313	±.010
2	.500		2.120	
3	1.500		1.830	
4	2.500		1.590	
5	3.500		1.390	
6	4.500		1.240	
7	5.500		1.150	
8	6.500		1.070	
9	7.500		1.030	
10	8.225	±.005	1.500	±.005
11	9.500	±.001	.875	±.001
12	10.775	±.005	3.250	±.005
13	9.500	±.001	5.625	±.001
14	8.275	±.005	4.978	±.005
15	7.500	±.001	4.250	±.001
16	7.500	±.001	3.250	±.001
17	2.641	±.005	3.929	±.005
18	1.500	±.001	5.625	±.001
19	14.000	±.001	6.500	±.001
20	9.250	±.005	.250	±.005

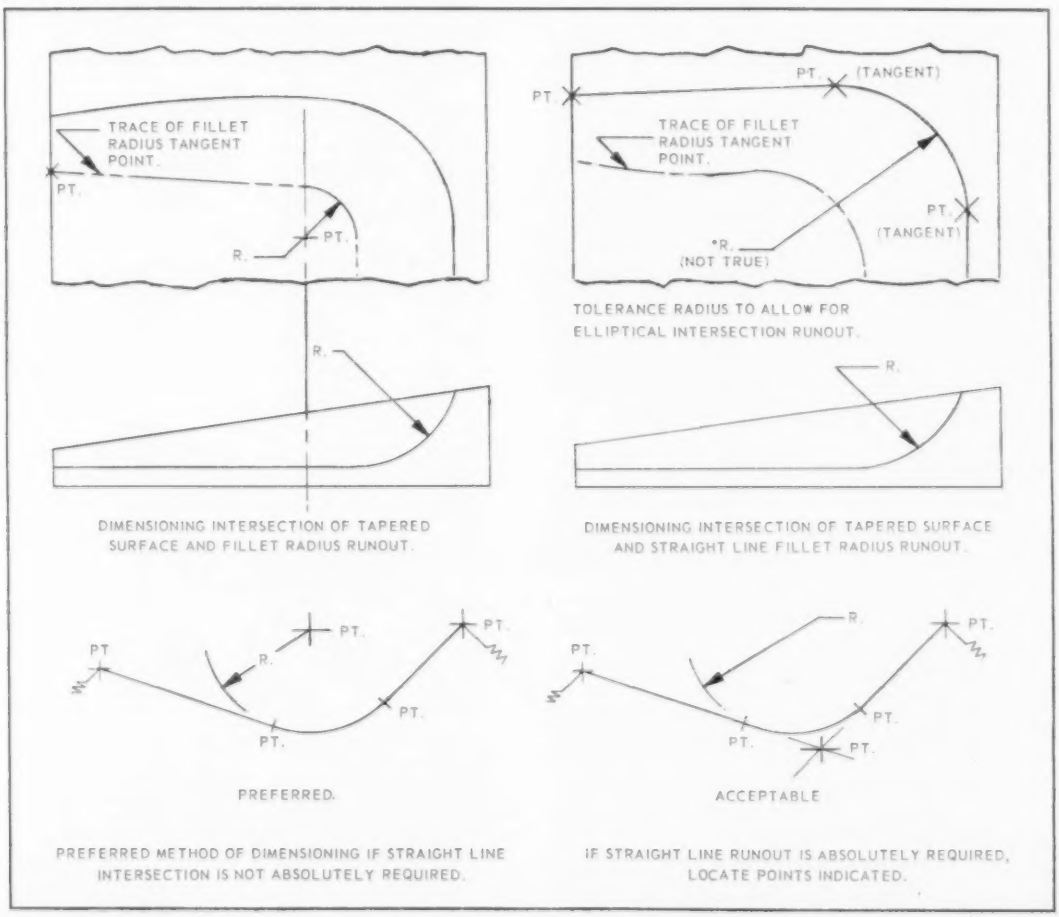
Fig. 5. Tabulation of points in *Fig.* 2 show those tolerances which differ from the title block tolerances.

6. Reduction of inspection time is effected. After the first part has been inspected, a visual check is all that is required for following parts
7. Automatically controlled feed rates increase tool life.

Typical parts that are being successfully programmed and machined at Norair include snark missile fin walls, empennage door panels, wing tank doors, and die cavities. On one typical job involving the production of a 2500-lb die mold, conventional methods require 390 hours and a total media cost of $800. The same die mold, produced by programming with numerical control involved only 36 hours to produce with a media cost of $2.50.

Plotting equipment for use in verifying machine tool control tapes is being developed by several logistics equipment manufacturers. Such a development would provide an accurate method of checking programmed tapes. Prospective plotting and orthographic views of the part could be produced prior to setup on the numerically controlled machine. Until tape-checking equipment becomes available, tape reliability can still be improved by a systematic and thorough approach to every phase of tape making and machine operation.

Fig. 6. (below) Methods for dimensioning intersections of curves and lines. Preferred and acceptable methods are shown.



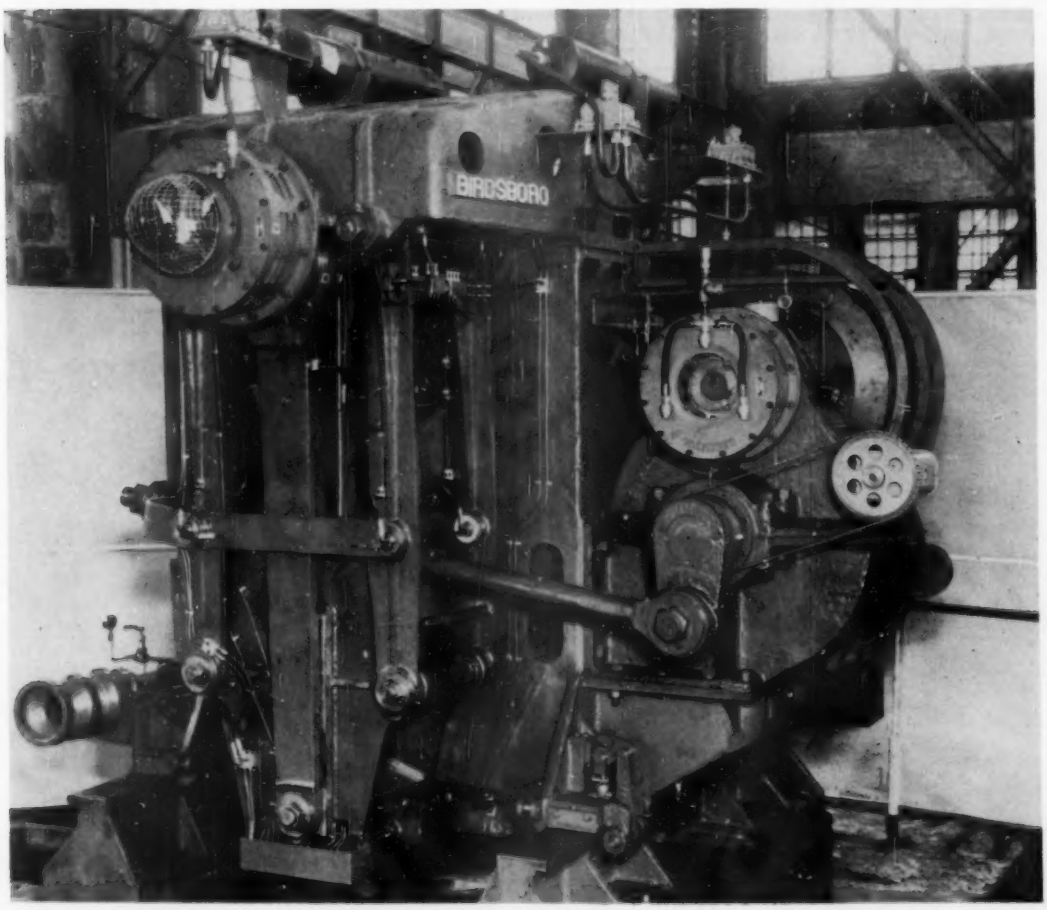
designed for

PRODUCTION

New Billet Shear Eliminates Hooked Ends

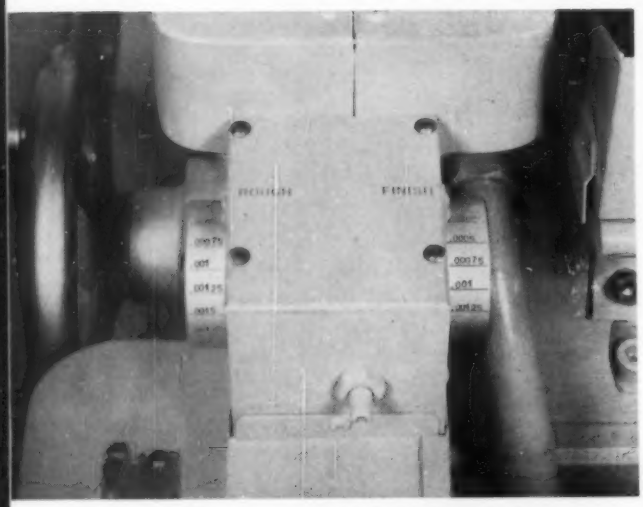
Billets up to 2½ inches square are cut at speeds ranging up to 600 fpm on a billet mill flying shear designed and built by Birdsboro Steel Foundry and Machine Co. Through use of a two-throw crank, top and bottom knives are given an up-and-down cut shearing action which eliminates hooked ends.

To eliminate expensive electrical drive equipment, the shear is powered by two variable-speed d-c motors which run continuously. Each motor turns a flywheel pinion which meshes with a bull gear keyed to the end of a crankshaft. One crankshaft has a double throw action for actuating the knives and the other a single throw action for moving the knife head with the bar. Electrically timed air clutches initiate the crankshaft actions in proper sequence. The machine has been installed at the Monessen, Pa. plant of the Pittsburgh Steel Co.



DESIGNED FOR PRODUCTION

Grinder Sharpens Cutters Automatically

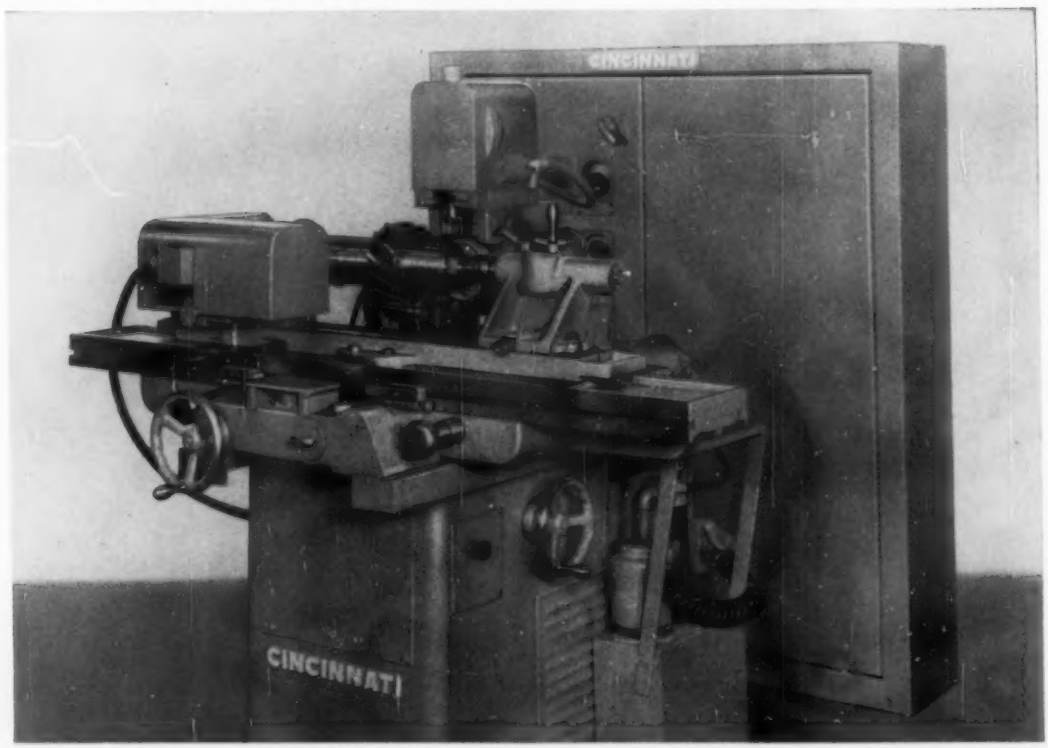


WHEEL DRESSING is initiated by control box at upper center. Variable torque motor at headstock holds cutter against toothrest at predetermined pressure.

Automatic operation of a cutter grinder developed by Cincinnati Milling Machine Co. enables operators to sharpen cutters while maintaining production on the mill. A time-saving advantage of the grinder is programming of automatic wheel dressing at predetermined intervals. Advance of the diamond dresser is compensated for by a corresponding advance of the saddle pickfeeds. When a machine setup has been made, any number of identical cutters may be ground without further operator attention. To maintain concentricity, a cutter is rotated 180 deg after rough grinding. By this method the effects of tool wear are minimized.

In operation, a variable torque motor indexes the cutter into proper position again the toothrest. A second torque setting, preselected on the control panel, establishes correct pressure between cutter tooth and toothrest. A limit switch indexes the cutter at the end of each tooth grind.

SADDLE PICKFEED can be set for either rough or finish grinding. Graduated dials provide a feed range of 0.00025 to 0.005 inch.

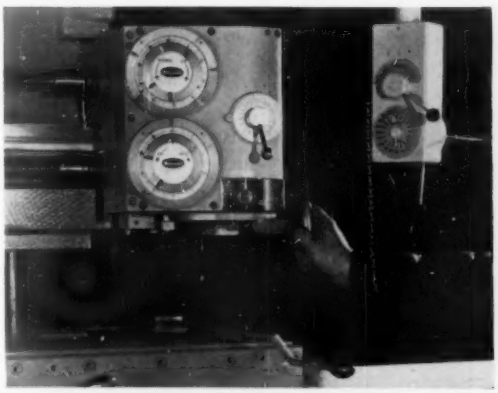


Power Controls Increase Lathe Efficiency

All machine motions are power-controlled for increased efficiency on the Bullard vertical turret lathe illustrated. Tool slide movement is controlled by a horizontally swinging arm and is infinitely variable from 0 to 9 fpm. The tool slides can be moved horizontally, vertically or at 45 deg angles.

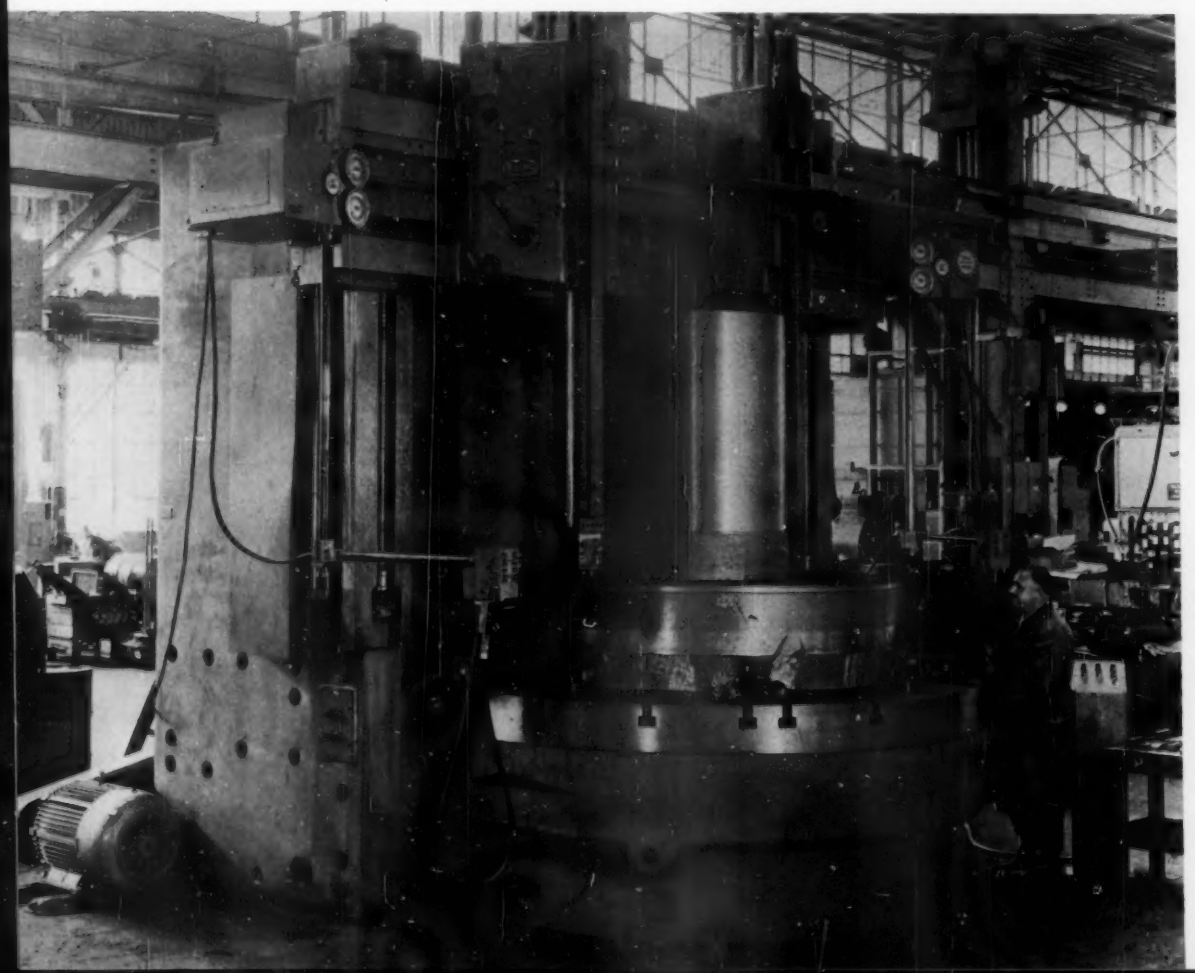
Clock type dials with dual pointers provide visual control of the head for accurate and fast positioning of cutting tools. Graduated in tenths and thousandths of an inch, the dials remain stationary while pointers rotate to indicate head position.

Nonproductive time in machining is reduced by coupling feed rates with table rotation. Table speeds can be varied without changing the speed-feed ratio. Feed ratios can be altered to match changes in stock removal conditions or to adjust for tool wear without stopping the machine.



TOOL SLIDE MOVEMENTS are actuated by handle beneath control box at center. Dials on box are used to govern tool position relative to workpiece.

BELOW—Separate dial systems and control panels on larger lathe enable the operator to watch and control machining operations, at either side of the table.

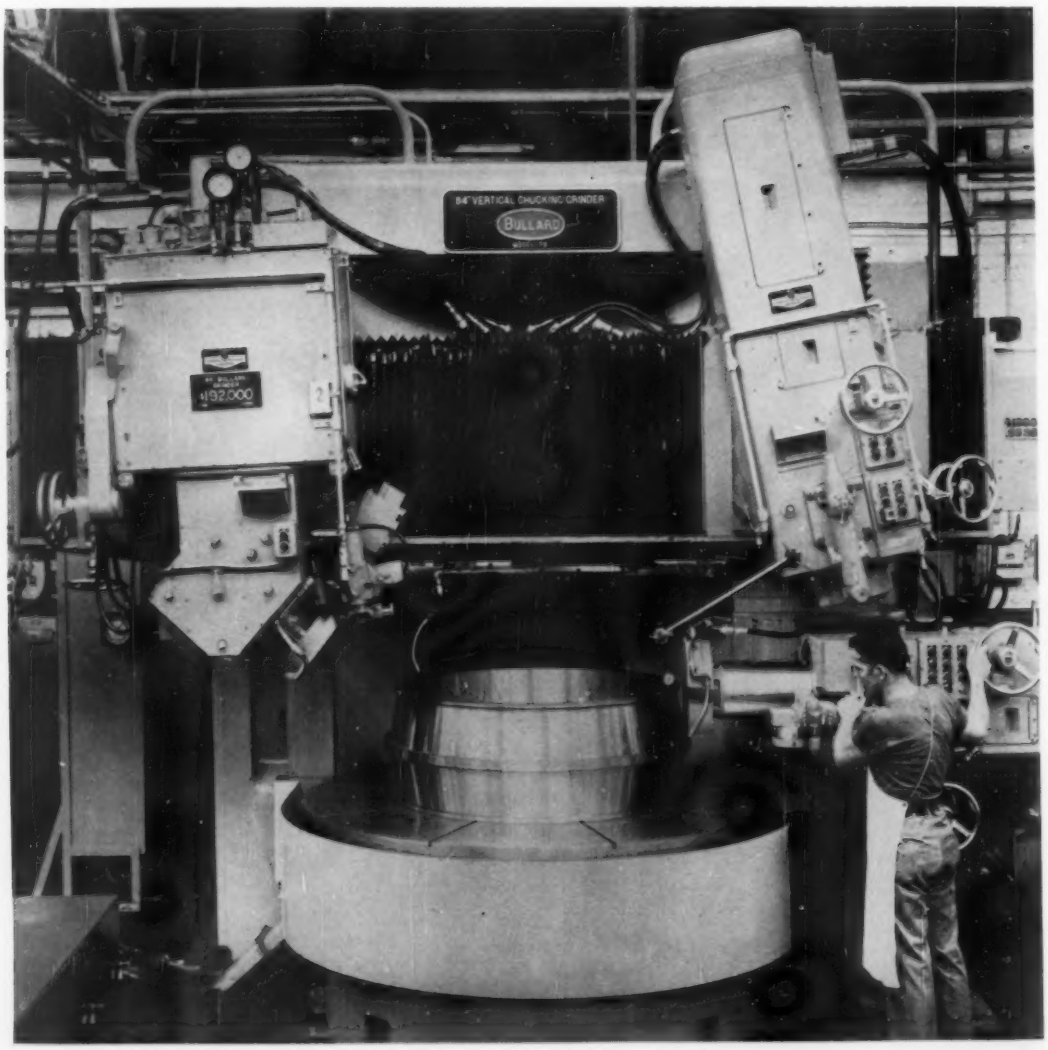


DESIGNED FOR PRODUCTION

Three-Head Machine Grinds Seven-Foot Bearings

Bearings with outside diameters greater than seven feet are finished on a vertical chucking grinder built for Timken Roller Bearing Co. Over 20 ft long and nearly 15 ft high, the machine is capable of grinding large bearing cups, cones or thrust raceways to within 0.0002 TIR.

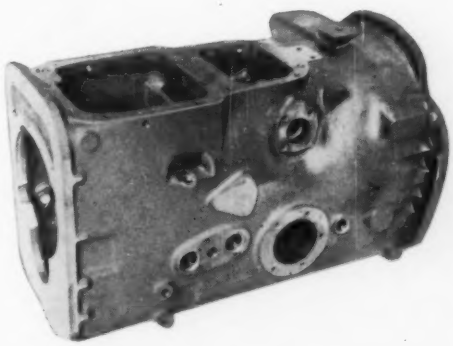
To obtain maximum versatility, the machine is equipped with three grinding heads, each of which has a special function. All heads are mounted on hydraulically controlled slides and are adjustable for variation in grinding wheel angles.

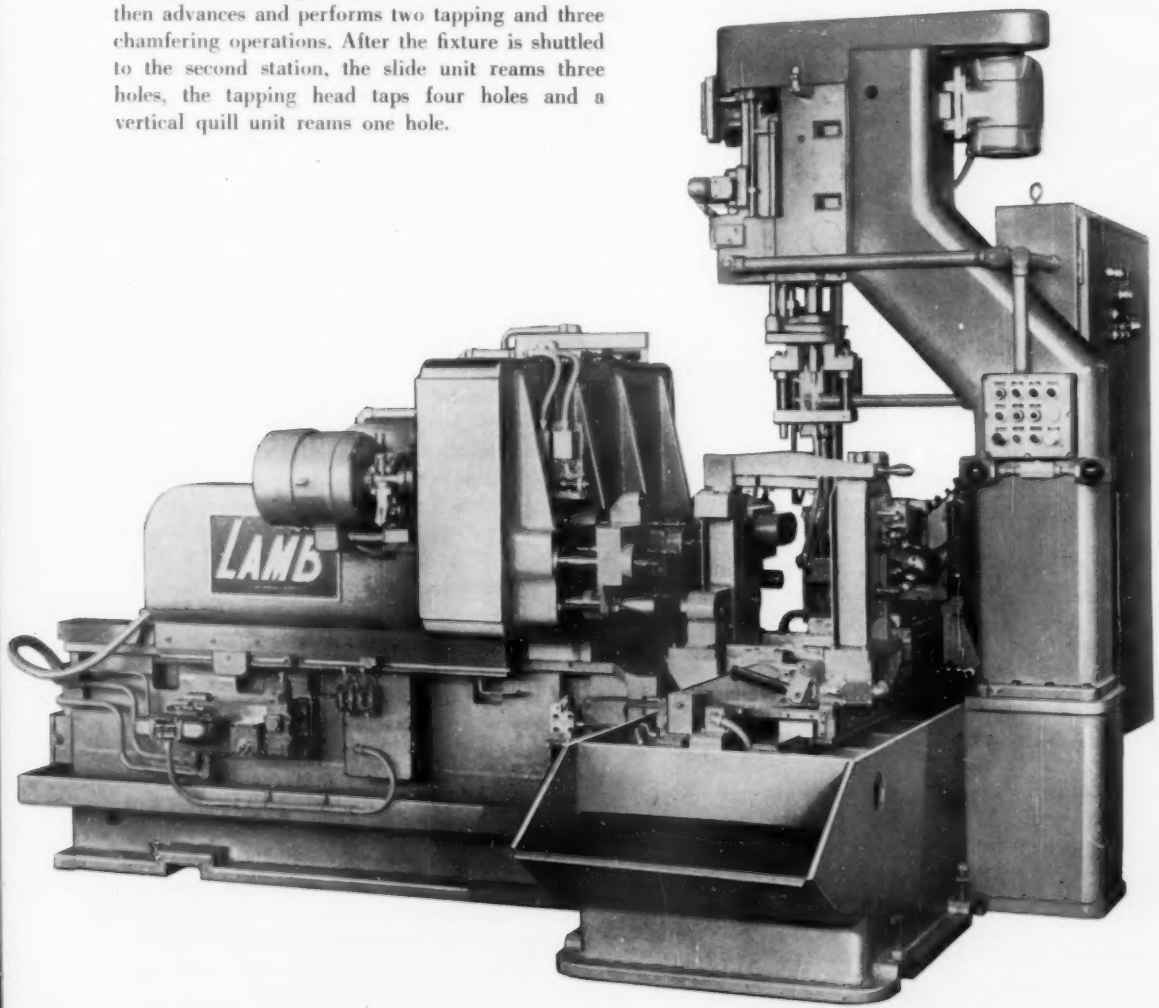


Two-Way Shuttle Machine Has Standard Components

Utilizing a single fixture and a two-way shuttle mechanism, a machine developed by F. Jos. Lamb Co. of Detroit taps, chamfers and reams horizontally and vertically on three faces of tractor transmission cases. Low production requirements permit shuttling of the fixture and part, eliminating the need for more complex handling, positioning and clamping mechanisms. Tooling costs are minimized through the use of standard taps, reamers and chamfering tools. The use of basically standard components permits alteration of the machine to meet design changes.

To start a machining cycle, the workpiece is loaded manually, positioned on locating pins and hydraulically clamped. The horizontal slide unit then advances and performs two tapping and three chamfering operations. After the fixture is shuttled to the second station, the slide unit reams three holes, the tapping head taps four holes and a vertical quill unit reams one hole.





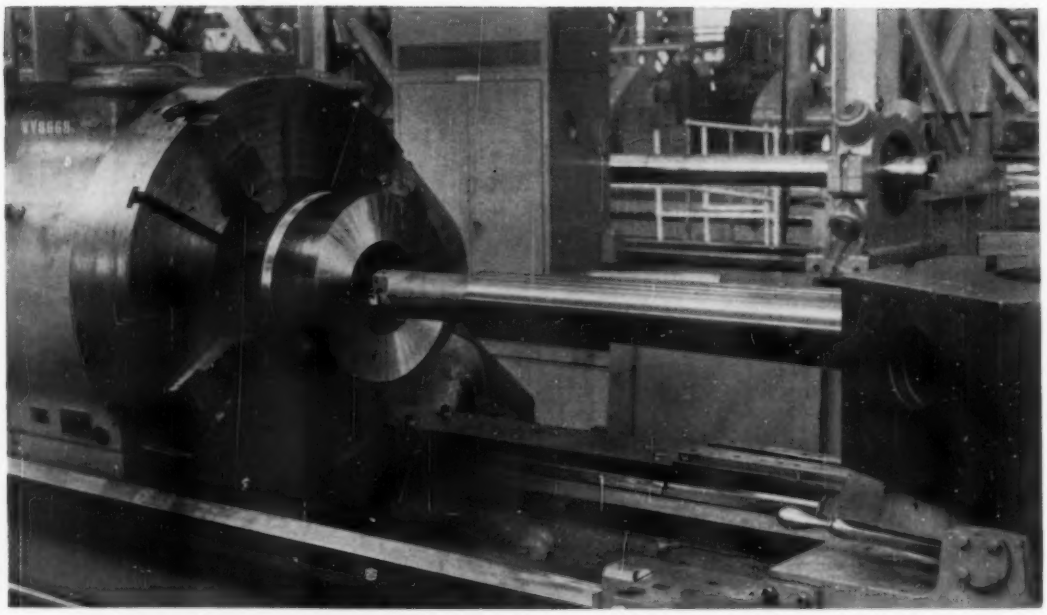


Fig. 1. Carbide bar positioned for boring of the powder chamber in a 120mm gun tube.

CARBIDE BORING BAR halves machining time

By Leo T. Parker*

Project Leader
Production Methods Unit
Operations Div.
Watervliet Arsenal
Watervliet, N. Y.

Rigidity of carbide makes it an excellent material for long boring bars. Close tolerances can be held and metal removal rates are higher than with steel bars.

CARBIDE CUTTING TOOLS can increase productivity tremendously. In some operations, however, it has not been possible to take full advantage of their inherent potential because of limitations in the machine or in the cutting toolholder. One solution is to make the toolholders themselves of carbide to take full advantage of the rigidity and vibration damping characteristics of this material. At Watervliet Arsenal, a hollow carbide boring bar has given outstanding results in machining the long contour of the powder chamber in gun tubes, *Fig.* 1. The gun tubes are alloy steel with a 375-400 Brinell average hardness. Yield strength is 150,000-180,000 psi. The boring bar operation requires a 125-microinch (rms) finish. Powder chambers are machined in a hollow-spindle turret lathe, *Fig.* 2.

Until a few years ago, high-speed steel contour reamers were used to develop the finish form on all gun tubes. The contour was developed in four steps. First, a high-speed steel step reamer removed the bulk of the excess stock. A second reamer then removed the steps and roughed in the contour. The finished contour was developed by a finish form reamer. After reaming, the chamber was polished in a separate benching operation. Because of the slow feeds and speeds required when reaming with high-speed steel, these operations were long and costly. Also the cost of the rough and finish contour form reamers was high.

Although the reaming method is still used for large gun tubes and for small production quantities, it has been largely replaced by rough and semifinish

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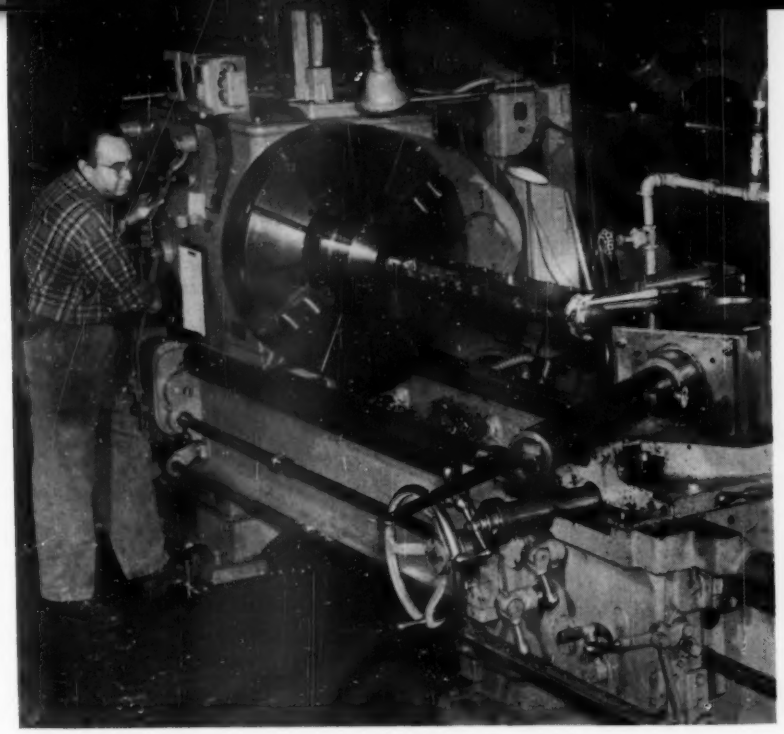

Fig. 2. Setup for machining powder chamber. Here contour reamers are being used. Same basic setup is used for boring.

boring operations, using an air-cylinder tracing device and a carbide cutting tool. In early attempts at boring, the tool was held in a long steel boring bar. After boring, the chamber was finish ground to size in an internal grinder. With the new method, tooling costs were reduced but, because of the inherent qualities of vibration and deflection in the steel bar, the results were far from satisfactory.

This deflection was caused by the high ratio of bar length to bar diameter (8:1). In contour boring, it was desired to semifinish the bore to within 0.015 inch of finish size prior to grinding to size. Because of deflection, it was impossible to maintain 0.015 inch of grinding stock for the full length of the contour. Invariably, the rear end of the bore would have 0.030 to 0.050 inch of stock remaining. The condition was partially corrected by making several passes, with each pass removing a little more stock in the rear end of the bore. Although this method was more economical than reaming, it was felt that further reduction in time was possible.

In an effort to solve this problem, various styles of brazed-on carbide tools were tried. Use of the harder carbide grades was impractical because of brazing problems, and the excessive vibration caused premature tool failure through rapid tool wear and flaking of the top face of the tool.

With the advent of throwaway carbide inserts, harder carbides were used but vibration problems became more critical, since vibration caused more uneven tool wear and flaking than was encountered with the softer carbide grades.

The next improvement was dictated by serious operational limitations encountered when machining the powder chambers of 90mm gun tubes. Five hours were required for semifinishing the contour, with approximately 1.200-inch stock removal, and as many as eleven passes were needed to meet the 0.015-inch requirement for the finishing operation. Accordingly, carbide reinforcing strips along the steel bar were tried, *Fig.* 3. These were brazed on.

Immediate improvements were obtained. Machining time was decreased to two hours and the number of finish passes was reduced to four. Vibration was decreased to a point where the use of harder carbide grades for the throwaway inserts was practicable. Flaking of the top surface of the tool was reduced to a minimum and only one cutting edge was used for each gun tube. Previously, one cutting edge was used per pass. Bore-size consistency was improved to within 0.015-0.020 inch for the full length of contour. This reduced the time required for grinding.

An additional advantage derived from the use of carbide strips was the reduction of bar diameter. Because of the deflection problem, the steel bar was designed as large as possible. Chip flow was there-

Reaming versus Boring

Operating Variable	High-Speed Steel Reamer	Steel Bar		Reinforced Bar		Carbide Bar
Gun size, mm	120	76	90	76	90	120
Speed, rpm	6	120	81	196	150	150
Speed, fpm	9	100	82	150	165	220
Feed, ipr	0.060	0.015	0.012	0.015	0.018	0.020
Depth of cut, in.	——	0.100	0.100	0.125	0.125	0.250
Overhang, in.	——	27	28	27	28	43.5
Deflection, in.	——	0.060	0.050	0.010	0.010	0.002
Passes, No.	——	11	12	5	5	7
Time, hr	9.2	5	5	2	2	4

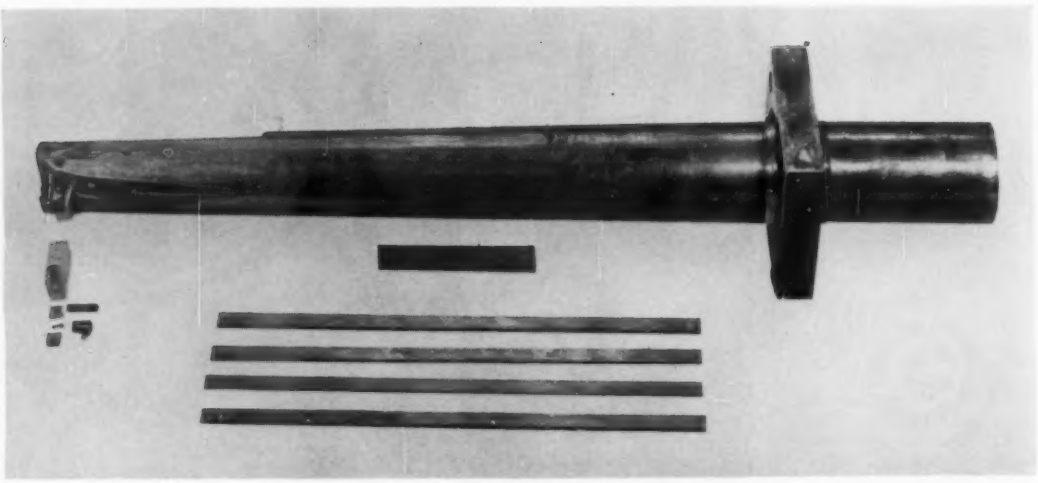

Fig. 3. Boring bar with carbide reinforcing strips.

fore restricted. It is important that chips have room to be washed out of the bore by the coolant; otherwise they may pack around the bar, score the finish or restrict bar movement.

Use of carbide strips for reinforcement was successful in a bore of 24-inch length and such bars were applied for the machining of several thousand gun tubes, including 76mm, 90mm and 106mm models. In late 1957 a boring bar was required to machine a 120mm gun tube. This gun tube has a powder chamber 40 inches long and a bar length to diameter ratio of approximately 12:1. A steel bar was tried out but was unsuccessful. With the steel bar bore size variance from breech end to muzzle end of the chamber was 0.050 to 0.060 inch. Because of this size variance, the decision was made to use special high-speed steel contour reamers. Operational time to semifinish the powder chamber prior to grinding was 9.2 hours. Cost of the special powder chamber reamer was $120.84 per tube.

The possibility of using carbide reinforcing strips was investigated, but the 4.700-inch bore size limited the boring bar diameter. A carbide boring bar was suggested as being more practical. The boring bar ultimately developed is of tungsten carbide and is 3.500 inches in diameter on the small end and 5.000 inches in diameter on the larger end, to fit the machine turret. Over-all length is 64.500 inches.

First test results were highly successful. Vibration and deflection problems were practically eliminated. Depth of cut was 0.200 inch, feed was 0.02 ipr and speed was 150 fpm. The entire cost was amortized in six months. A comparison of the production results obtained from the carbide bar with those from previous methods is shown in the accompanying table. The fact that depth of cut with the carbide bar is double that possible with the carbide-reinforced steel bar—despite the 64 percent increase in bar length—is particularly noteworthy. Savings over the reaming method are nearly $107 per tube; savings over the use of a bar with carbide strip reinforcements are almost $33 per hube. These savings are based on a production run of 100 pieces.

Precision-ground ½-inch square throwaway inserts of a C-8 grade of carbide are used. Lead angle is 15 deg. The cutting fluid is a water-soluble emulsion. As a result of the success with the carbide boring bar for 120mm gun tubes, it has been decided to use carbide boring bars for all similar operations where production quantities are sufficient to warrant their use. The carbide bars are definitely superior to the steel bars with carbide reinforcing strips. It may also be possible to use carbide bars for the quills used for finish grinding the powder chambers. This would result in faster operation and improved accuracy.

"And regarding a production boost in this department, send out a box of thumbtacks!"

SELECTING SPRINGS
from stock lengths

By Raymond D. Bohannon*
Standards Engineer
Kingsbury Machine Tool Corp.
Keene, N. H.

Problems of cutting off stock springs to length can be solved with simple proportion charts. The author shows how to set up the charts and illustrates several ways in which they may be used.

IN MANY MANUFACTURING PLANTS, compression springs are stocked in long lengths and cut to length as required for use. In such cases it is convenient to have a quick method for determining the appropriate length required for a specific application.

Assuming a constant modulus of elasticity, the total deflection of a compression spring is directly proportional to the compressive load and also to the number of active spring coils, or, the length of the spring. This relationship can be represented on a proportion chart, and the chart used to find the value of any one of the three variables under specified conditions for a segment of the original spring.

The method of constructing such a chart is shown in *Fig.* 1. The vertical scale on the left, *BC*, represents the length of the original spring and is calibrated from zero to the free length of the spring. On the other side of this line, values of load are placed corresponding to deflections on the spring length scale. The length of the load scale, *CD*, is equal to the total deflection of the spring when compressed to solid height, or, the free length minus the solid height. A convenient distance from the scale a point *A* is selected and the triangle *ABC* constructed. A line is drawn from point *A* to the value of solid height on the length scale at *D*. Any vertical line *EF*, since it is parallel to *BC* will be divided in the same proportion as *BC* by line *AD*. A chart is constructed for each spring carried in stock. Data for the chart scales are obtained from the spring specifications.

A typical chart is shown in *Fig.* 2. The spring used in this case has a free length of 18 inches and load of 83.3 lb at the solid height. These values are used to plot the scales as shown.

The following examples of spring selection problems illustrate the use of the proportional charts:

Spring Length from Load and Deflection: Suppose the spring in *Fig.* 2. is to be cut off to a length such that when a load of 30 lb is impressed upon it, the compressed length will be 7 inches. The solution to this problem is shown in *Fig.* 2, and the steps are numbered in order. A line (1) is drawn from point *A* to the load scale at 30 lb. A horizontal line (2) is then drawn from the 7-inch point on the length scale to intersect this line. This intersection determines the location of the vertical line representing cut-off spring. The height is projected horizontally to the length scale on the left (3) giving 9¼ inches as the required cutoff length.

Load from Deflection: If the spring in the foregoing example is compressed to a length of 4 inches, what is the load? This solution is also shown in *Fig.* 2. Draw a horizontal line from the 4-inch length on the scale (4) to intersect the vertical line. Draw a line (5) through point *A* through the intersection and extend it to the load scale. The value of the load at this condition is 72 lb.

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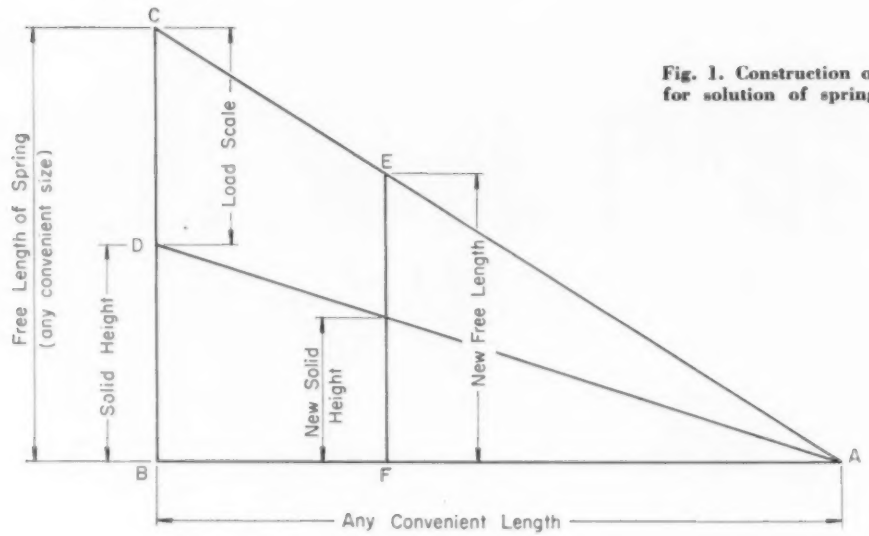


Fig. 1. Construction of proportion chart for solution of spring cutoff problems.

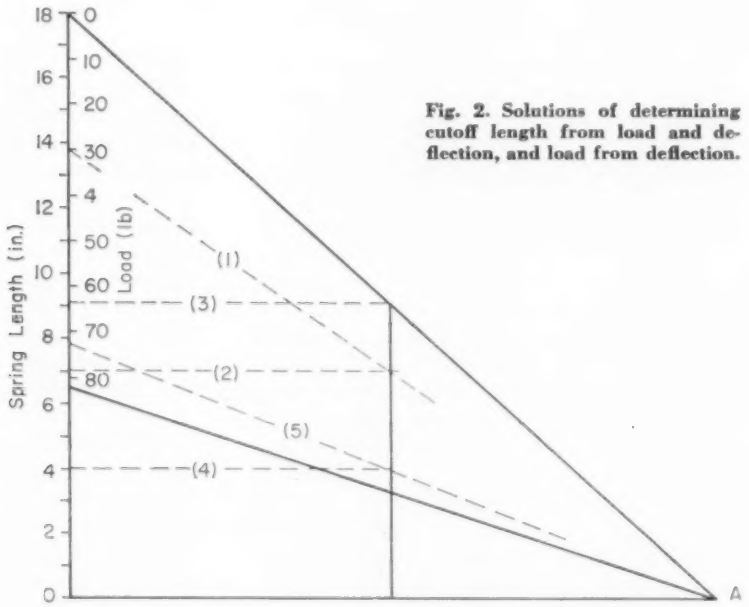


Fig. 2. Solutions of determining cutoff length from load and deflection, and load from deflection.

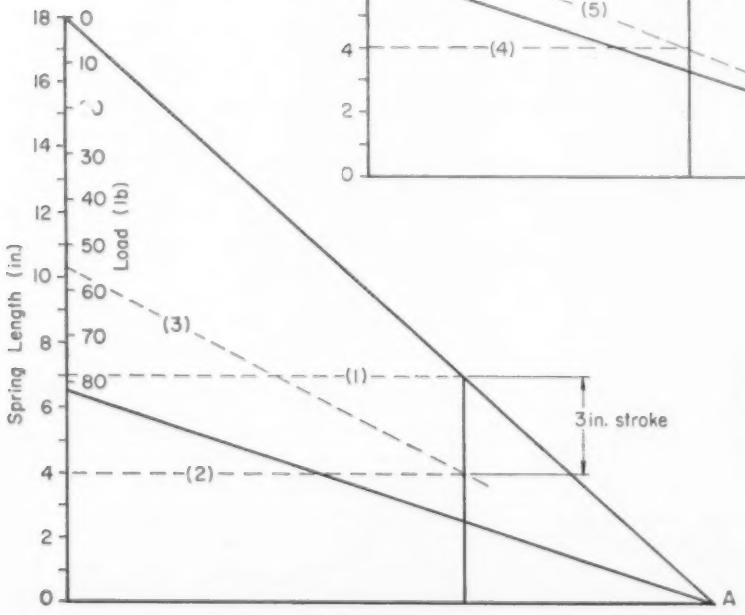


Fig. 3. Solution for finding load at a given deflection from length of spring segment.

Load from Length and Stroke: Consider again the spring stock used in the first two examples. If this spring were cut off to a free length of 7 inches, what would the load be when the length has been compressed 3 inches?

This solution is shown in *Fig.* 3. The cutoff length of 7 inches is projected (1) from the length scale to the hypotenuse of the triangle. This determines the position of the line representing the spring segment. Move down this segment line 3 inches as shown on the length scale (2). The answer of 55 lb on the load scale is shown by line (3).

Length from Load and Stroke: Another example of the same spring is shown in *Fig.* 4. It is required to have a 20 lb load at the beginning of a 7 inch stroke. At the end of the stroke, the spring will be compressed to solid height. How long should the spring be cut off?

Draw a line (1) from 20 lb on the load scale to point *A*. Then draw a line 7 inches from and parallel to the proportion line (2). Where these two lines intersect, draw a vertical line. This line shows that the spring should be cut 14½ inches long (3).

Load from Deflection: If a stock spring with a free length of 10½ inches were cut off at 8 inches and compressed 1 inch, what would be the load? With a working stroke of 2.75 inches, what is the load at the end of the stroke? The solution is performed as shown in *Fig.* 5. The load at the deflection of one inch is 10 lb. At the end of the stroke the solid height is reached and the load is 40 lb.

The examples discussed illustrate most of the problems involved in cut off spring selection. Other problems may be encountered in which the information needed is of the same nature as the given data in these examples. Such problems are solved simply by reversing the steps shown in the examples.

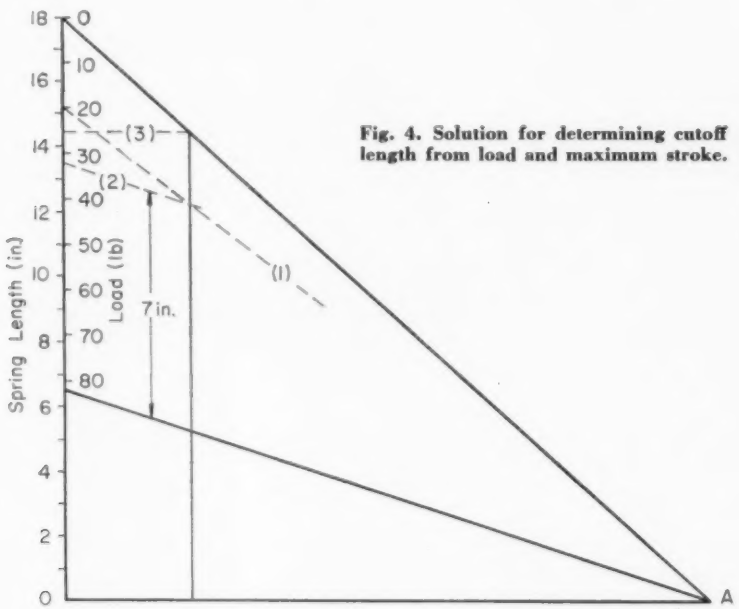


Fig. 4. Solution for determining cutoff length from load and maximum stroke.

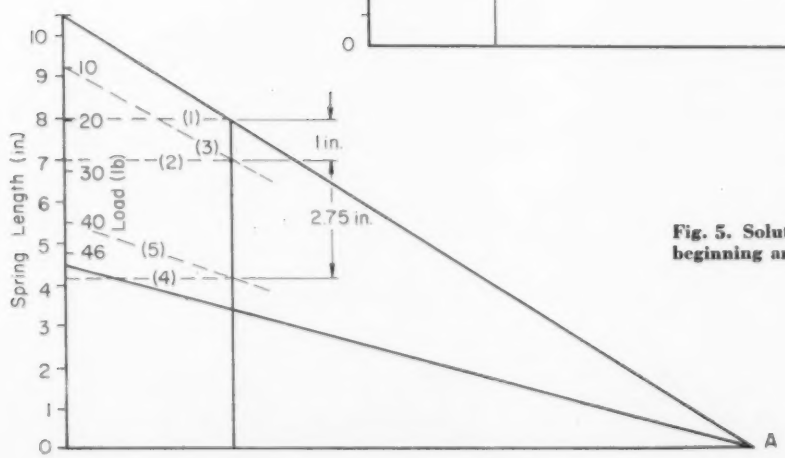
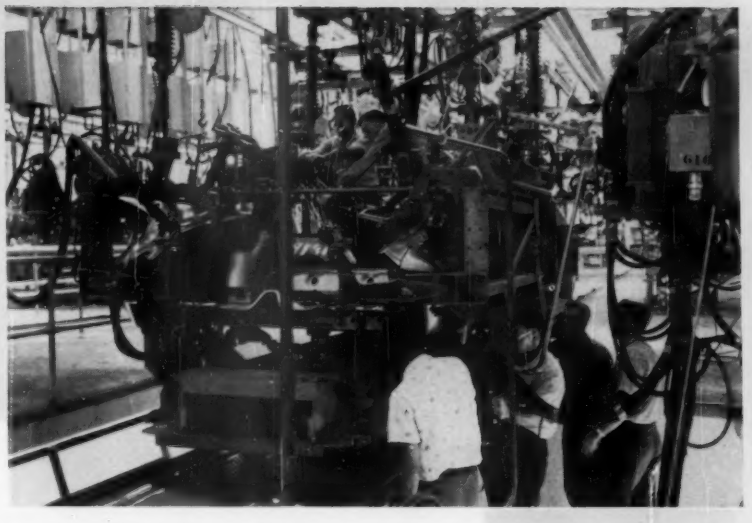


Fig. 5. Solution for finding loads at the beginning and end of a working stroke.

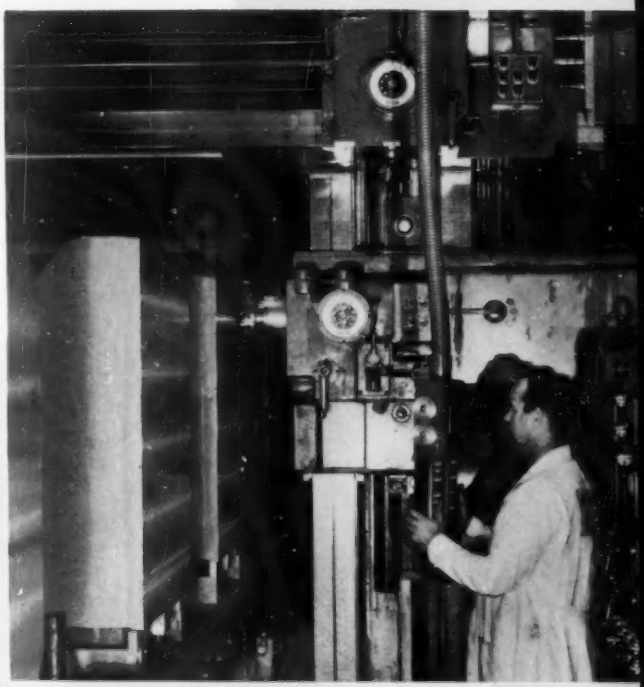
STAINLESS STEEL CASTING for a turbine housing assembly is machined in four chuckings using carbide and high-speed steel tools on a Warner & Swasey No. 3 universal turret lathe. The part requires machining to within 0.001 inch on four-inch diameters, with surface finish to 32 microinches rms and concentricity within 0.002 TIR. To assure accuracy, the workpiece is held in a special face plate adapter during finishing.

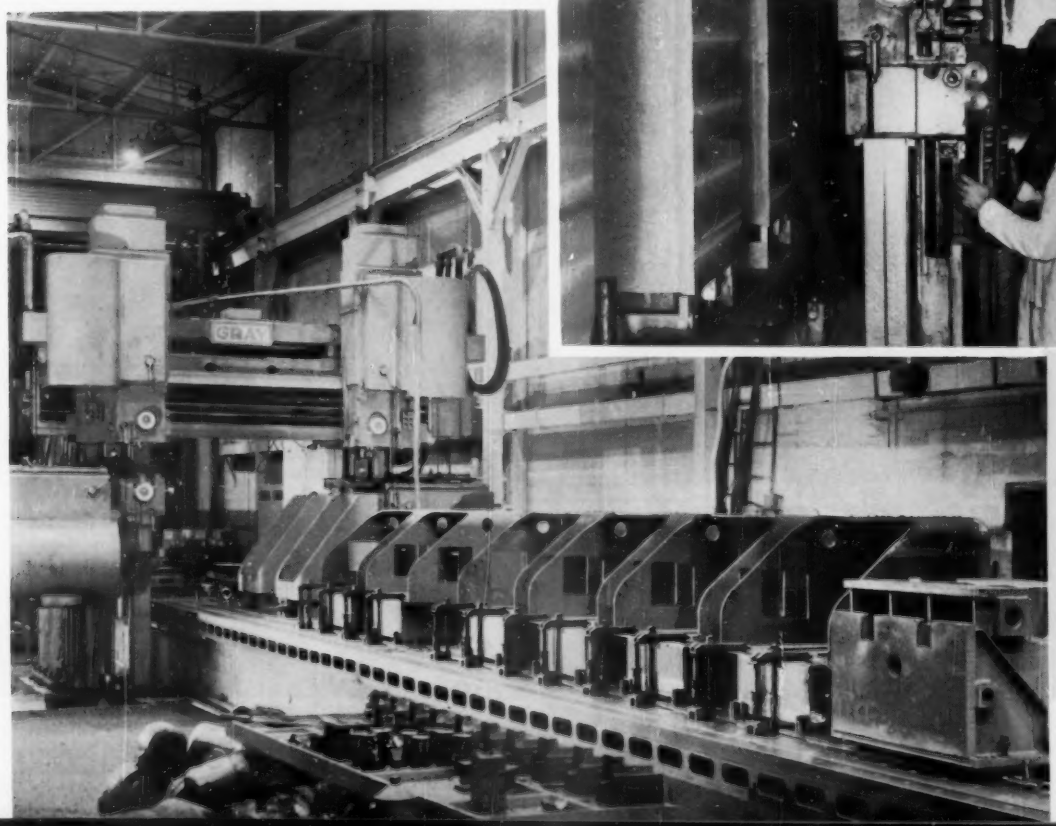
TOOLS at work

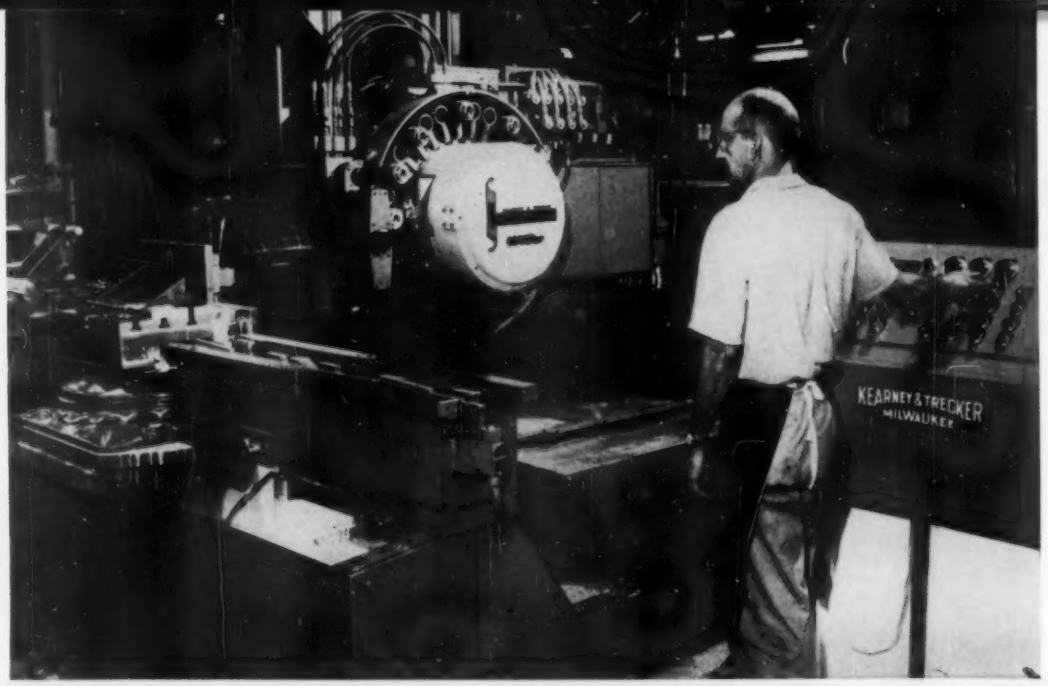
CAR BODY side assemblies are welded to a floor pan at Chrysler Corp. pre-production pilot plant in Detroit. Quality control program carried out at the plant pretests parts, tools and assembly techniques before volume production assembly is begun.



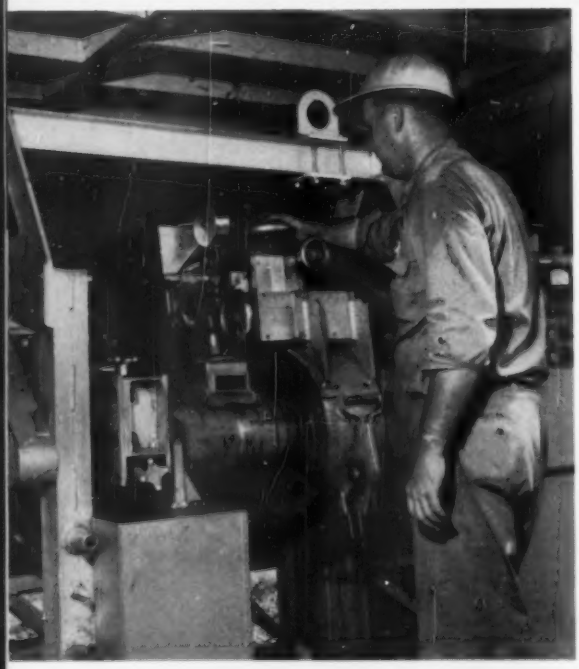
UNSIMILAR PARTS are lined up on a planer-miller at Buhr Machine Co. so that the surface of each can be milled in one setup. Two 25-foot tables on the machine can be joined together for big pieces or loads of parts, or can be used separately so one table can be loaded while parts on the other can be machined. Parts are standardized units for special multiple-operation machine tools.





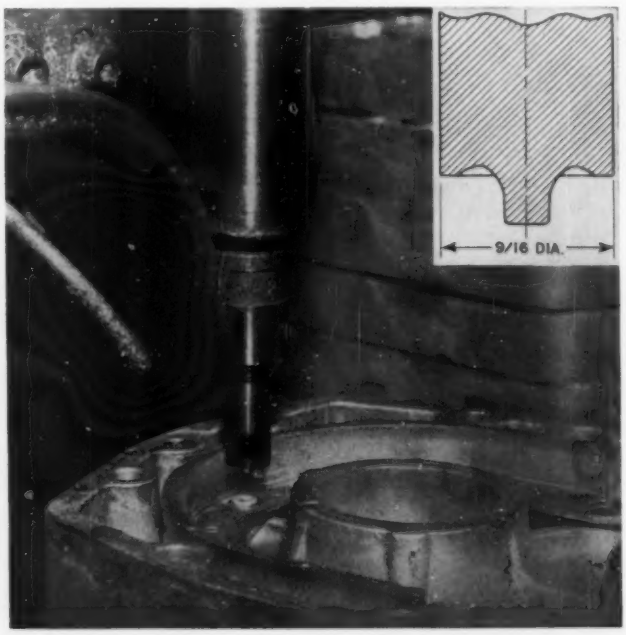


NUMERICALLY CONTROLLED combination milling, drilling and boring operations are carried out on a Kearney & Trecker Milwaukee-Matic at Boeing Airplane Co. Various aircraft parts such as elbows, housings or forgings of the size and type that would roughly fit into a 18-inch cube are processed. General Electric point-to-point equipment is used for tape control, programmed manually or by computer.



AUTOMATIC PIPE WELDING machine completes a pass on 8-inch aluminum pipe in 17 seconds. Developed by Alcoa, the unit is used to join 40-foot pipe sections in the field. Inert-gas-shielded-arc consumable process is used. Wire electrode feeds from a spool to the pipe joint. Backup rings are not needed.

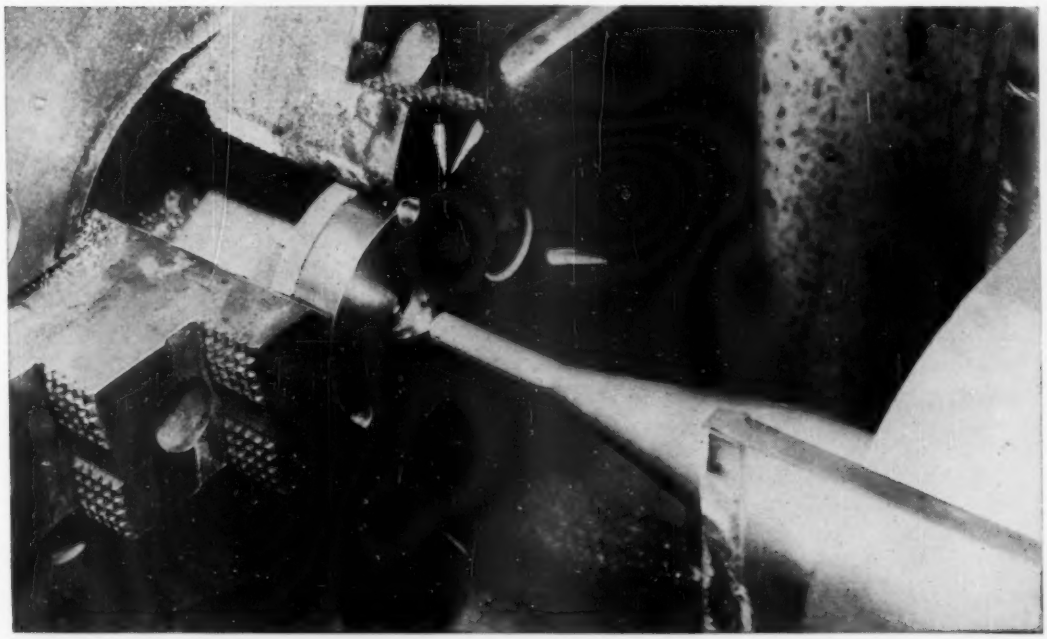
ALUMINUM RIVETS are cold spun with carbide tools during an automatic cycle at 36,000 rpm. A light initial contact heats the rivet. The tool is then retracted to permit mist spray lubrication and moved down again to complete the riveting. Tools are Kennametal grade K82 carbide.

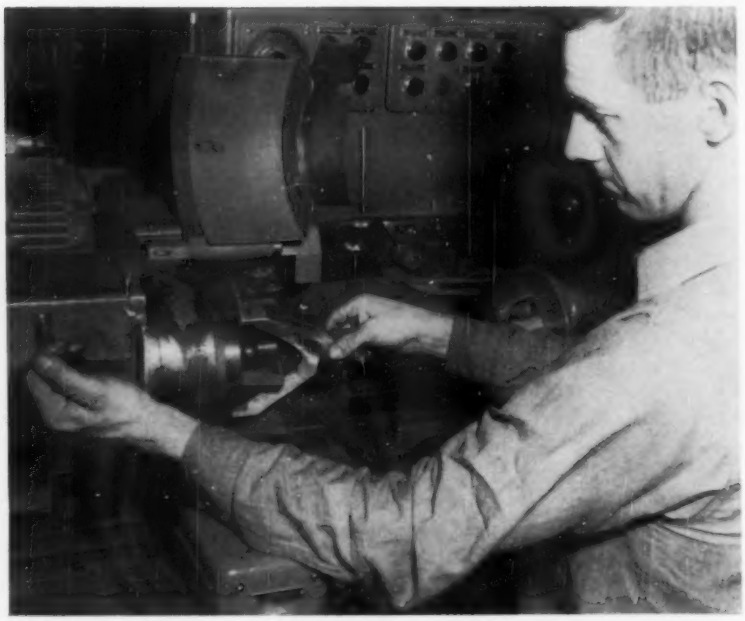


SPECIAL REWIND LINE reduces the amount of tension in steel strip before it goes to annealing furnace by electrically controlling bridle. This tension reduction prevents sticking resulting from the annealing process. Line, built by E. W. Bliss Co., has, along with the bridle, a mandrel type pay-off reel, a tension reel, two coil buggies and a pinch roll.

TOOLS at work

HIGH-STRENGTH, heat-resistant alloy tubing is swaged from two to one-half inch diameter in eight stages utilizing nested aluminum tubing to prevent collapse during the process. A standard engine lathe is used as the power source with conventional drawing dies of Ampco bronze. Process was developed at Boeing Airplane Co.

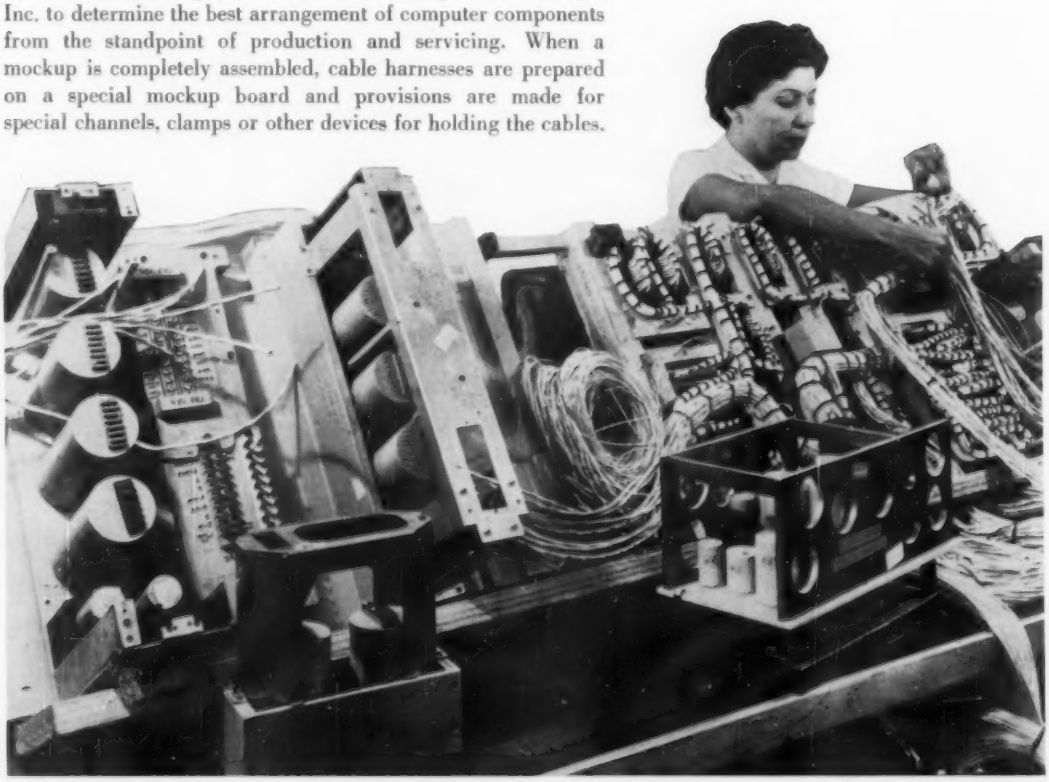




OPERATOR loads a looper drive eccentric for an industrial sewing machine into a drawbar fixture in a Heald Model 171 Gagematic. The machine, equipped with 30 sets of additional fixture equipment and two high-frequency heads in addition to the belt-driven head, grinds bores of 47 different parts at Union Special Machinery Co.

TOOLS at work

DUMMY SUBASSEMBLIES, meters and other integral components made of wood are placed in wooden mockups at Librascope, Inc. to determine the best arrangement of computer components from the standpoint of production and servicing. When a mockup is completely assembled, cable harnesses are prepared on a special mockup board and provisions are made for special channels, clamps or other devices for holding the cables.



VIBRATIONS

cause grinding rejects

By T. E. Douglass
Assistant to the President
Simonds Worden White Co.
Dayton, Ohio

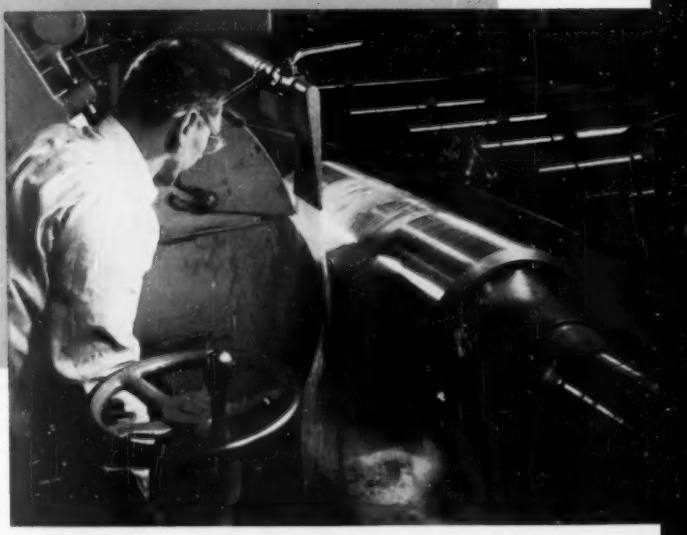


Fig. 1. Grinding of rolls used in the production of steel foil.

Inferior surface finish, often attributed to an unbalanced grinding wheel, may be caused by machine vibration. Fast detection, analysis and correction of vibration at its source is possible with electronic checking equipment. As a preventive maintenance tool, it can lengthen the life of capital equipment.

SURFACE FINISH is usually considered solely as a function of the grinding wheel. If a balanced wheel of proper grit and bond is used, it is expected to produce an acceptable finish. Usually it does, but in work requiring a fine finish, machine vibrations as well as wheel balance must be investigated as causes of surface imperfections.

Finish grinding of rolls, *Fig.* 1, used in foil manufacture is an example of the necessity of eliminating vibration to produce a fine finish. All imperfections in the surface of the rolls will be reproduced on the surface of the foil. Because some steel foils used for memory cores in electronic computers are rolled to a thickness of 0.000125 inch, surface finish of the rolls is a factor of major importance. Other examples of stringent finish requirements are found in the missile and paper-cutting industries. Missile nose cones require surface finishes on the order of two microinches. In the manufacture of paper cutting knives, a finish of three microinches is required. Extremely fine finishes are mandatory if these and other high-precision products are to function properly.

If vibration is established as the cause of surface flaws, it is necessary to determine whether the source is internal or external. If internal, it may be traced to the wheel or mechanism in the machine. If external, vibration dampeners may be necessary on the machine mountings. In extreme cases it may be necessary to isolate the entire machine foundation to minimize extraneous vibrations originating in sources outside the grinding machine.

Unbalance: Displacement of the center of gravity of a rotating part is called unbalance. When an operator mounts a grinding wheel, he balances the system by truing the wheel and adjusting the weights. This practice must be followed although the wheel may have been perfected and electronically balanced by the manufacturer.

The magnitude of centrifugal force produced by unbalance is a function of the speed of rotation. This force, which is the cause of vibration, increases as the square of the speed of rotation. As shown in *Fig.* 2, one ounce-inch of unbalance in a part rotating at 500 rpm produces 0.443 lb of centrifugal

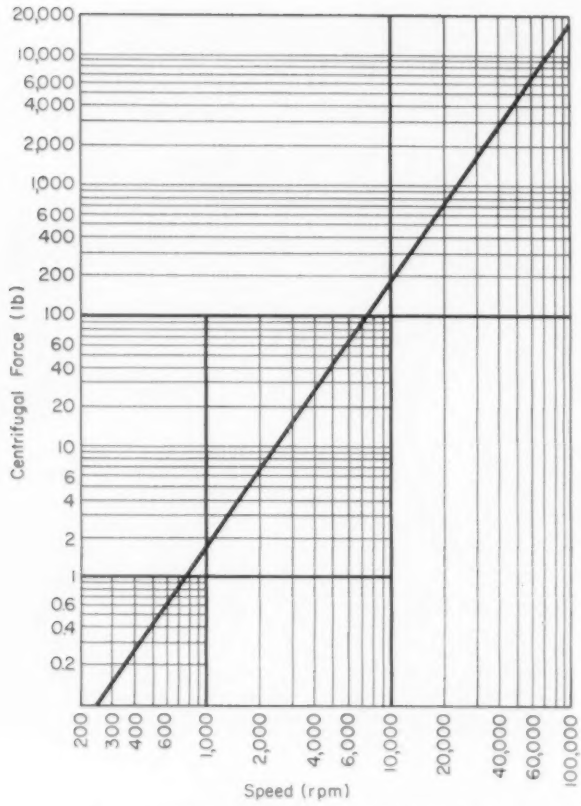


Fig. 2. Relationship between vibration and speed of rotation. Unit of displacement is one ounce-inch.

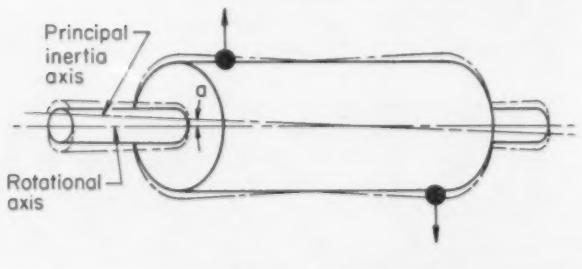


Fig. 3. Sketch showing forces causing dynamic unbalance in rotating machine components.

force each time the part makes one rotation. At 5000 rpm, vibrational force has increased to 44.3 lb.

Principle sources of unbalance in rotating parts include:

1. Mechanical looseness, pounding and misalignment
2. Torque pulse vibrations in electric motors
3. Belt vibrations
4. Oil whirl in lubricated sleeve bearings
5. Aerodynamic vibration in bladed fans
6. Unmachined portions of castings or forgings which are not concentric or symmetrical with the axis of rotation
7. Lack of homogeneity in materials.
8. Nonsymmetrical distortion of a body while running at operating speeds
9. Eccentricity of the inner race of ball bearings
10. Bent shafts, chipped gears and worn parts.

Types of Unbalance: Both static and dynamic unbalance can occur in a rotating part. Static unbalance occurs whenever the center of gravity of a system does not lie on its rotational axis. It is most easily observed by mounting the part on horizontal, parallel knife-edges commonly used for balancing grinding wheels.

Dynamic or couple unbalance is represented by two equal weights on opposite sides and at opposite ends of a rotating part. It occurs if the principal inertia axis of the rotating body forms an angle with the rotational axis, *Fig.* 3. When not restrained by bearings, the rotational axis will generate intersecting cones about the principal axis.

It is possible for a system to be in perfect static balance and show characteristics of dynamic unbalance during rotation. This is because the centrifugal forces of the two weights are not in the same plane perpendicular to the axis of rotation. These forces create a couple which acts upon the shaft, producing a vibratory motion at the journals. This vibration will result in a poor surface finish which is often attributed to the wheel.

Due to their comparatively short axial lengths, grinding wheels are usually adjusted for static unbalance only. This condition is corrected by the addition of one counterweight. Many other parts of the machine such as shafts and armatures, however, are affected by dynamic unbalance which must be removed by the addition of a series of counterweights in two planes.

Balancing Methods: If internal vibration has been established as the cause of inferior surface finish, it is necessary to locate the faulty component. This can be done by trial and error—generally a tedious, costly process—or by the use of electronic test equipment. The use of electronic methods, is preferable because it enables the operator to measure magnitude of vibration and to identify faulty components while the grinder is in operation. In many cases unbalance can be corrected without removing the defective part from the grinder.

Electronic equipment has also made it possible to balance grinding wheels without removing them from the machine. In one plant, time spent for mounting a wheel has been reduced from two hours to fifteen minutes through the use of electronic balancers. In many instances vibration tolerance ranges have been established for the grinder as a unit. When the over-all level of vibration exceeds a prescribed range, the machine components are rebalanced. This technique is being used increasingly as a preventive maintenance tool.

CAST-TO-SIZE DIES
prove economical

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and
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Casting to size is a practical process for fabrication of some draw dies. Judicious application of the process can result in reduced lead time and dollar savings in draw and form die tooling programs.

INDUSTRY is making increased use of cast-to-size castings in an effort to reduce machine time required for draw die fabrication, *Fig.* 1. Conventional castings, particularly those used in automotive manufacture, normally require the removal of 1/8 to 3/4 inch of stock. The amount removed is dependent upon size of the casting, complexity of its configuration and the accuracy of its pattern.

By contrast, cast-to-size castings require a minimum of machining and spotting. Such castings, upon cooling, are theoretically at finish size. Details of configuration are complete and dimensionally correct. Deviations from exact finish size are due to inaccurate patterns or poor foundry techniques.

Proponents of the process contend that increased surface hardness which results from casting to size increases die and punch life. However, any comparison of the metallurgical aspects of the two processes is irrelevant in most cases. Selection of either process is dependent on a comparison of the economies each system offers. Such economies vary with the shape of the castings.

Casting Technique: The major difference in manufacturing cast-to-size castings and conventional castings is in the patterns required. In conventional foundry practice, patterns originate from a pine model of the desired part or from a plastic skin fitted to that model. Generous allowances are made in the pattern for metal shrinkage and machine stock. Finer details of configuration are largely ignored because of the excess stock required for machining. These details must be reproduced from a "keller cast" by a keller, hydrotel or milling machine. Time required for machining is proportional to the complexity of part configuration.

Cast-to-size patterns, however, must originate from precise master models. Accuracy of this type of casting is dependent upon the accuracy of the model. Allowance for metal shrinkage must be made in the master. This can be accomplished by expansion plaster, which expands after being poured. Plaster expansion can be controlled and frozen at a

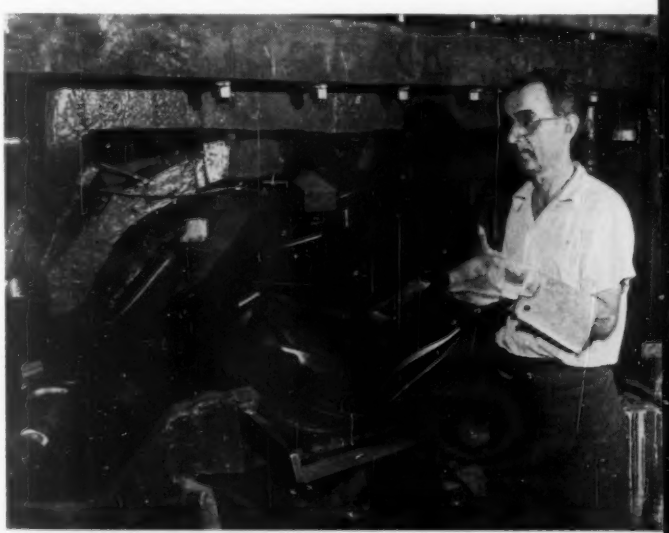

Fig. 1. Rear body-lock pillar stamped from a die fabricated with cast-to-size castings.

Table 1—Factors Affecting Choice of Casting Methods

	Cast-to-size	Conventional
Material cost, $	675	523
Time to construct patterns, man-hours	200	120
Time to machine and spot the punch and pad, man-hours	292	551

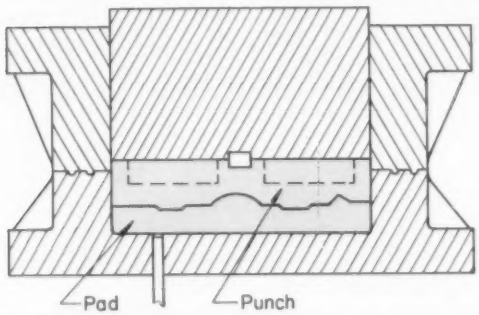

Fig. 2. Section of draw die showing cast-to-size details.

desired point by various techniques.

After the expansion plaster has been frozen at the correct size, it can be used to make a foundry pattern. Precautions which must be observed are:

1. Wall thickness should be as uniform as possible
2. Fillets should be used wherever sections form right angles
3. Vertical walls and core boxes must have some draft
4. Nails must be set and resultant holes filled
5. All surfaces must be smooth and free of cracks.

It is recommended that lacquer or some surface sealer be used on all wood surfaces. Plaster laid directly on a raw wood surface may lift and form an undesirable back-drafted condition. Because the finished casting will be a direct reproduction of the pattern, detail accuracy and finish determine the success or failure of cast-to-size castings.

Diemaking: Cast-to-size castings are taken directly from the foundry to the punch-finishing department. No preparatory machining of configuration is required. To correct minor discrepancies, the punch is spotted conventionally.

While the punch is being finished, a cut is taken off the base of the female (die) casting. Punch and die are then brought together and placed in a spotting press. The punch is shimmed to place it in a plane parallel to the base of the die. The die is then spotted to the configuration of the punch by conventional methods.

When the female casting has been spotted, a line parallel to the press bed is scribed on the punch base. This setup line is used to machine the base in a plane parallel to the die base.

This is one method of die construction but other methods now being developed will be equally effective. A basic consideration in any method is that very little room for error in alignment exists between two cast-to-size details, *Fig.* 2.

Table 2—Time Required to Machine and Spot Castings

Die (type)	Cast-to-Size (hr)	Conventional (hr)
Flange die	80	156
Draw die	67	172
Restrike die	26	83

Economics: Cast-to-size castings can effect savings in keller time on certain jobs. On other jobs conventional castings are more economical. Before specifying cast-to-size castings, tool engineers should evaluate die designs on the basis of the following:

1. Estimated casting weight
2. Estimated pattern cost differential
3. Estimated savings in keller-cast requirements
4. Estimated savings in machine time.

Cast-to-size castings are more expensive than conventional castings and their patterns cost more to fabricate. The cast-to-size process does not require fabrication of keller casts and it will effect savings in keller time. If estimated machining and keller-cast savings exceed higher material and pattern costs, casting-to-size should be specified.

Chrysler Corp. has made several evaluations of the process by comparing costs of right and left-hand dies where one set of dies is built conventionally and the other with cast-to-size castings. To eliminate any cost differential existing between vendors, all dies were purchased from the same source.

One set of dies selected was the rear body-lock pillar shown in *Fig.* 1. The draw die punch and pad were the only cast-to-size details, so only these details are reflected in the comparison chart, TABLE 1. Comparative results of these two dies are not sufficient to establish a basis for general policy decisions. However, they do indicate that cast-to-size castings are feasible for certain dies.

A comparison chart for punches and pads, TABLE 2, shows similar results. No constant ratio can emerge because the degree of configuration is variable. As configuration grows more complex, the ratio becomes more favorable to cast-to-size castings. In other cases where castings have large open surfaces, conventional castings are preferable.

Initial experiments with a cast-to-size program should be limited to castings showing the greatest probability of success. Dies for unexposed panels requiring medium to small punches with a high degree of configuration are ideal for such experimentation. As experience is gained by foundries, patternmakers and customers, it will become less difficult to decide which process to specify.

Fig. 1. Checking with template to assure fit on the rear section of a die model for a Ford quarter panel.

TREATED WOOD *proves dimensionally stable*

By George Kloote
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Properties of phenolic-treated woods have proved advantageous not only for die models but also for steel-rule dies, master models and shell-molding patterns.

MANY MATERIALS have been used for die models, *Fig.* 1. One of the best of these is wood, which is easily worked with common tools. The advantages of this workability are often offset, however, by lack of dimensional stability.

Most satisfactory wood for die models is mahogany. Yet mahogany has its drawbacks. It is highly sensitive to changes in humidity, expanding as the humidity rises and contracting as it lessens.

Since the making of a model might entail as much as 4000 hours, or two man-years of work, with the accompanying capital expenditure, it became increasingly necessary to find a new material

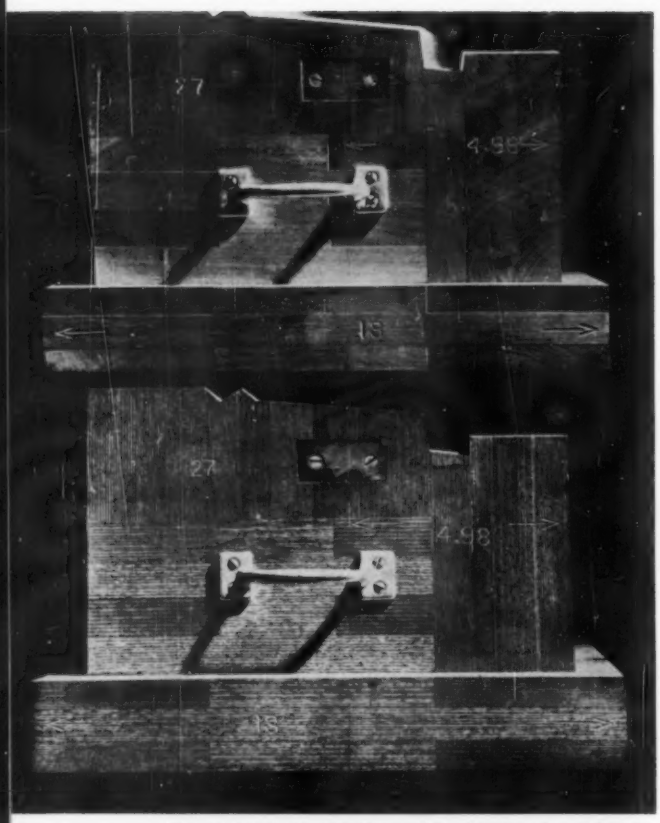


Fig. 2. End view of die models showing irregularities of model made of untreated wood and smoothness of model made from treated wood after both had been exposed to high relative humidity for one month.

to eliminate as much as possible the changes in the model during fabrication. For this reason the Ford Motor Co. engineering and research staff worked closely with the United States Department of Agriculture's Forest Products Laboratory to find a way of reducing the instability of mahogany.

During this research, mahogany was split into strips one-tenth inch thick, treated with phenolic resin-forming chemicals and then cured. It was found that the resin, formed within the walls of the cells of the wood, makes it about 70 percent more stable than any other wood known. These strips, glued together to almost any thickness desired, have the workability of the original mahogany yet maintain the dimensional stability which is characteristic of the thin slabs. This stability is shown in the test block in *Fig.* 2.

The material, named impreg, is supplied in slabs or planks about eight feet long and one inch thick, with width varying up to 14 inches. Because of the nature of the material it is possible to use these planks as received instead of having to dress them as had been necessary with the Honduran mahogany. Savings of up to 25 percent are made at Ford through this factor in material use. Planks are glued together to form blocks of whatever size is required by the die model to be made, and bracing of the same material also is formed.

One difference was noted in the mahogany after treatment. In the forming of sharp edges, impreg exhibits a little more britttleness than does the untreated wood. However, this was not found to be a serious problem.

Continuing research at Ford and the Forest Products Laboratory indicated that cativo wood, which is in much greater supply than mahogany, serves as well in the impreg. No marked differences have been noted in either stability or workability.

As it is currently used at Ford, the impreg is formed with the same tools that are used with mahogany. In most cases they are regular high-speed tools, although carbides are sometimes used. As in most die model making, aluminum templates are used to assure accuracy in the model.

When a model has been completed the impreg is treated with clear lacquer and a lacquer sealer. It is then ready to be kellered. Engineeering changes which may occur from time to time are incorporated on the die model with no difficulty.

Although impreg is more expensive than untreated mahogany, about 20 percent of the major cost of making a die model is eliminated, since that much is consumed in correcting dimensional movement. Still further economies have come about with the reduction of the cost of the material, which has dropped 50 percent since it was first manufactured by the Haskelite Manufacturing Corp. at the request of Ford. At the present time Ford uses impreg from two makers in order to assure a steady supply, since Ford alone uses more than 100,000 sq ft in one year's die models.

Thus, in its unending search for better ways of production, the automotive industry has again developed a material which not only aids that industry but also has potential benefit to other industries.

"It just doesn't like that particular operator."

welding developments
. . . new tools for production

By J. Frederick Parr
Associate Editor

Keeping abreast of technological development is a vexing task for engineers. An over-all picture of one manufacturing phase is hard to develop from periodic partial exposure to new technology. Presented here is a summary of recent developments in the field of pressure and arc welding designed to give an up-to-date review of the subject.

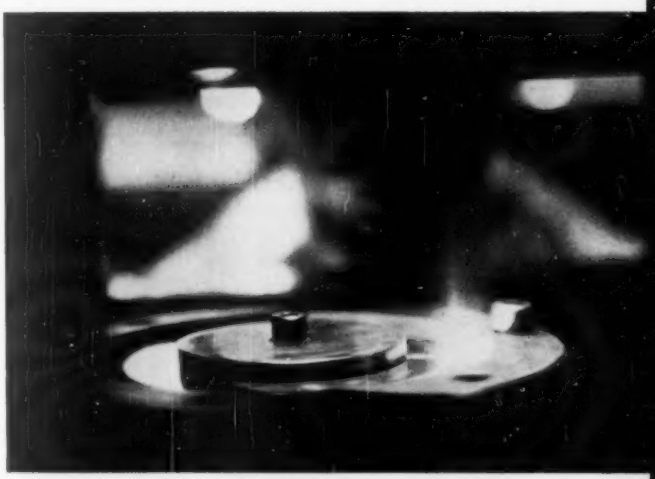


Fig. 1. Operator observes electron beam welding process inside high-vacuum chamber. Process affords high weld penetration without contamination.

As new demands have been placed on the science of welding, the challenges have been met with new techniques and equipment as well as improvements and modifications of older processes.

Two groups of welding operations which have undergone considerable advancement and growth recently are arc and pressure welding.

Electric Beam Welding

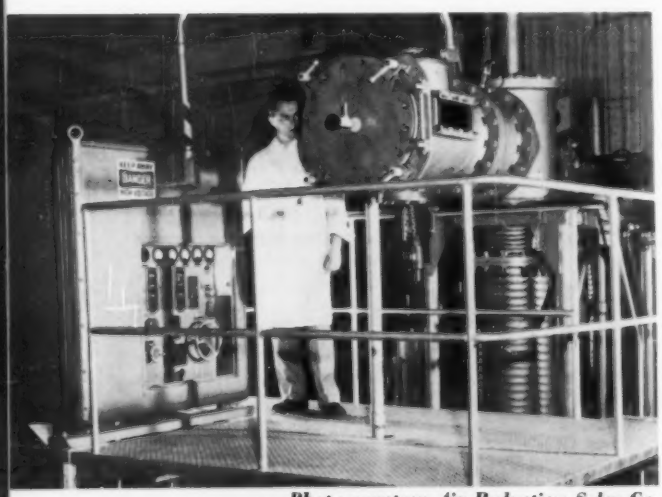
Perhaps the most spectacular of recent welding developments is the introduction of electron beam welding. This process is unusual in that welding heat is produced by bombardment of the metal surface with a stream of electrons, *Fig.* 1. The material to be welded is placed in a chamber under a high vacuum, *Fig.* 2. The beam is focused on the metal magnetically or electrostatically and can be made as small as $\frac{1}{16}$ inch in diameter. Differences in equipment developed by various manufacturers lie largely in the manner of beam focusing.

Applications: Upon impingement of the electron beam on the metal surface both melting and vaporization occur, forming a crater at the metal surface. Formation of this crater results in extraordinarily high penetration. Tests have indicated that a ratio

of depth to fusion width of 2 to 1 may be obtained. Since the metal is vaporized in a vacuum no contamination from the atmosphere can occur. In fact, the fused zone is often more pure than the parent metal since impurities boil off at the high temperatures attained. Resultant welds are stronger, more ductile and are free from porosity and slag inclusions. The high purity of welds is one of the main advantages over any other welding technique. There is an inherent safety feature in electron beam equipment inasmuch as failure of the vacuum is accompanied by failure of the electron beam which will not transverse a space not under high vacuum.

Highly reactive or refractory metals such as beryllium, molybdenum, tantalum, zirconium and hafnium which are difficult or impossible to weld by ordinary methods can be welded with an electron beam. In addition, metals with very high thermal conductivity can also be welded. Many applications are foreseen in the nuclear field, for example, welding clad fuel elements.

Limitations: Application of the process requires custom-built equipment for specific jobs. Since the process is operated in a high vacuum and at high voltage, investment in basic equipment, fixtures and auxiliary equipment is large. Critical review of conditions of operation to prove sound economics is necessary. Highly skilled technicians are required for operation of the equipment due to the complexity of the circuitry. However, in this regard, it is felt that eventual refinements in equipment design will simplify operation of the welder to the point that nontechnical personnel can be used.



—Photo courtesy Air Reduction Sales Co.

Fig. 2. Equipment for electron beam welding. Vacuum system is required to evacuate chamber.

Arc Plasma

The plasma jet has been known for some 35 years, however, only recently has equipment been developed suitable for commercial use. A plasma jet is a stream of gas heated to such a temperature that at least part of the gas is ionized. In arc plasma equipment, this temperature is reached by passing the gas through an electric arc. Gases commonly used are hydrogen, nitrogen or argon. Air can be used in suitable equipment. Controlled temperatures up to 30,000 F may be obtained. Any material known may be melted or even vaporized with a plasma jet.

Basically, there are two types of arc plasma devices: transferred and nontransferred arc, *Fig.* 3. In transferred arc equipment, the arc traverses from the cathode to the work which is the anode. In nontransferred equipment the arc is struck between tungsten electrode and a water-cooled electrode.

Applications: Arc plasma devices have a very high heat intensity and high rate of heat transfer. Due to the supersonic velocity of jet exit, molten metal is literally blown off the surface during welding. However, where great heat intensity and heat transfer are desired, good use can be made of the transferred arc.

The main use presently being made of arc plasma is arc plating. Metal in the form of a wire or powder is fed into the nozzle, melted in the plasma jet, and sprayed through the nozzle opening. The inert gas

—Data courtesy Linde Co.

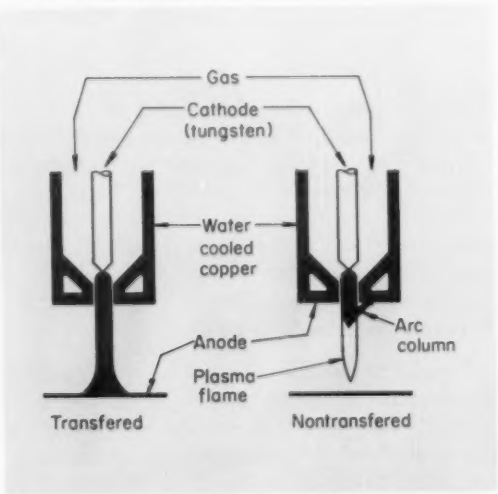


Fig. 3. (right) Transferred and nontransferred arc devices. Type depends on whether arc traverses to work or to nozzle.

carrying the melted particles often travels at speeds up to 10,000 fps. The spraying process is used for coating materials with refractory substances. Coatings have excellent bond to most any base material including some reinforced plastics, graphites and carbons. Sprayed coatings are dense, usually laminar in structure and may be finished to below 10 microinches. Coatings which have been successfully applied include: crystalline and amorphous boron to nickel parts, nickel containing barium and strontium carbonates to molybdenum, tungsten to many materials.

Virtually any material that may be melted and solidified again may be sprayed with an arc plasma torch. Some materials which are of industrial importance are:

1. Refractory metals such as tungsten, tantalum, molybdenum, niobium and rhenium
2. Refractory metal compounds such as borides of zirconium, tungsten, niobium, tantalum, titanium, chromium
3. Refractory carbides of niobium, hafnium, tantalum, zirconium, titanium, tungsten and vanadium
4. Refractory oxides of thorium, hafnium, magnesium, zirconium, cerium and aluminum.

Spraying to produce parts of irregular shape has proved to be one of the most successful and useful applications of the plasma arc torch, *Fig.* 4.

A mandrel is prepared to the precise internal diameter of the part to be made. Mandrels may be brass, aluminum or other suitable materials. The mandrel is chucked in a lathe and rotated. The selected material is sprayed by moving the torch back and forth across the spinning mandrel. When desired thickness has been reached, the torch application is stopped and the mandrel dissolved out.

—Photo courtesy Linde Co.

Fig. 4. Most useful application of plasma arc devices is construction of irregularly shaped parts. Shown are a variety of sprayed tungsten shapes.

Electro-Slag Welding

A recent newcomer to the welding scene is the electro-slag process, *Fig.* 5, developed in Russia. Electric current is passed through a bath of molten slag between a welding electrode and the workpiece. Melting occurs at the workpiece, slag interface and at the electrode wire forming a pool of molten metal. The molten metal and slag are retained between work parts by means of copper dams. The copper cools the metal at the bottom of the pool thus forming the weld. As solidification occurs, the electrode wire is fed vertically into the slag at a rate somewhat less than it is used, maintaining the end of the wire at a constant distance from the molten metal pool.

Parts more than two inches in thickness can be welded with a single stationary electrode. When the electrode is moved back and forth horizontally, welds of 6 to 8 inches may be made. By using an appropriate number of multiple electrodes, the technique can be used to make welds of unlimited thickness. Many applications are foreseen in construction of large weldments to replace forgings or castings, such as in presses.

Applications: One case where this process is applied commercially is in welding locomotive forgings at General Motors Electro-Motive Div., Chicago. Sleevelike cylinder head retainers are formed to cylindrical shape from flat strips and the ends welded together by the electro-slag method or, as it was

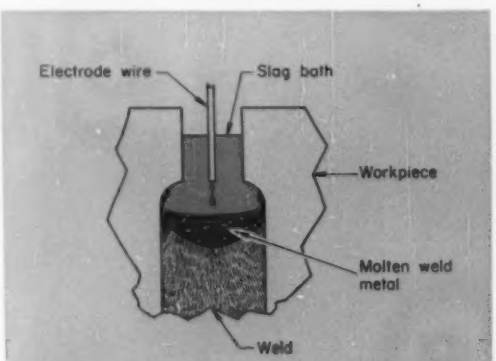


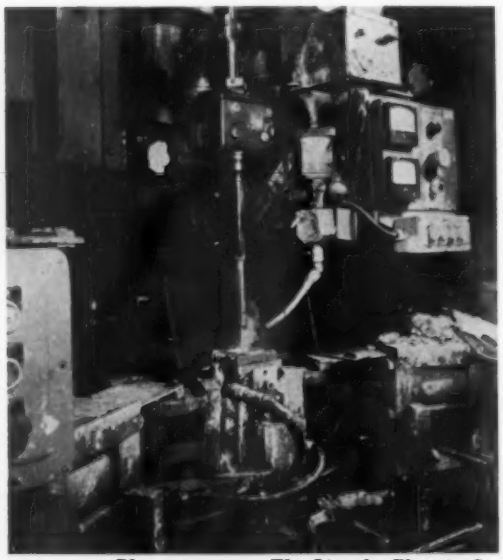
Fig. 5. Diagram of electro-slag welding process. Arc is immersed in a bath of molten slag. Electrode is consumed.

dubbed at General Motors, "electromolding."

The process required a special setup in a machine designed especially for the purpose, *Fig.* 6, but proved to have the advantage that a high grade uniform weld is made in a single pass.

After forming, the sleeve is put over a mandrel and clamped to bring the edges to be welded to the correct one-inch gap width. Clamping includes closing of water-cooled copper dams; one outside, one inside the retainer. At the bottom of the gap, a steel bar, *Fig.* 7, is place to maintain ground. A well results seven inches deep by one inch wide to be filled with weld metal.

The welding wire is fed from a Lincoln LAF welding head through a copper sleeve approximately in the axis of the weld. Since the part cross section is not uniform, the rate of retraction must be varied with a special mechanism. At its lowest point, the sleeve is three inches from the bottom of the well. Flux is fed from a glass hopper under control of a timer in such a way to keep the pool of molten metal submerged and the adjacent copper walls covered with a fused flux skin. Welding is done at 38 volts, straight polarity with an average current of about 1150 amp. Approximately 4½ minutes are required to complete the weld. A pipe is formed at the top of the weld which is later machined off. Total cost per piece is about 11 to 12 cents per pound as against 19 cents per pound for forgings.



—Photo courtesy The Lincoln Electric Co.

Fig. 6. Electro-slag welding of cylinder head retainers. Copper dams retain molten metal and slag.

Inert-Gas Metal-Arc

The development of CO_2 welding a few years ago opened new vistas for the welding field. Welding rates unattainable before are easy with CO_2 welding. The process is suited for and quickly adapted to automatic welding. Portable equipment has been developed that is hand held for making continuous seams with CO_2 as the shielding gas. Argon is used in the same manner, *Fig.* 8. Electrode wire is automatically fed from a spool.

This idea has been extended to the development of hand-held CO_2 spot-welding equipment. These devices sometimes are called "button welders" or "poke guns," *Fig.* 9. The finished weld resembles a buttonhead, *Fig.* 10. The size of the button may be varied by changing voltage, wire feed speed, weld current or time cycle. The main advantage claimed for this process is that surface conditions of the steel do not seriously affect the quality of the weld. Weld-

—Photo courtesy The Lincoln Electric Co.

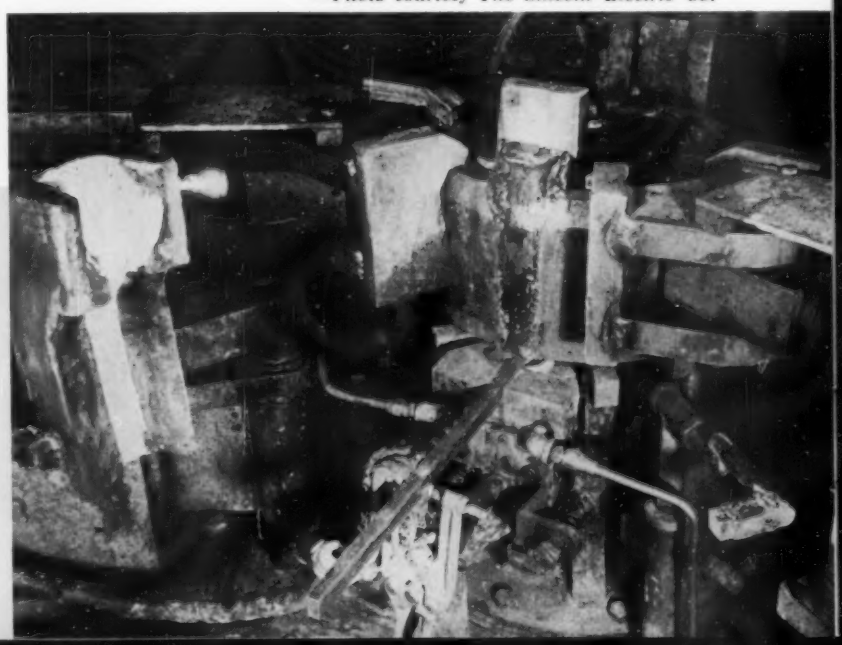


Fig. 7. Welder retainer after clamps and copper dams have been removed. Grounding bar is at center at the bottom of the weld. Pipe on weld is subsequently cut off.

ing can be performed through oil and grease.

The method is particularly adapted for burned-through joining of light-gage mild steel. The system can also be used as a method of tacking together heavier gage sheet and plate instead of arc tacking. Another application is plug welding heavy sheet metal where a hole is punched in the top sheet.

Dip Transfer Process: In some cases of high-speed welding, certain disadvantages are inherent in the CO_2 process, especially when welding low-carbon or low-alloy steel. The highly oxidizing nature of CO_2 may sometimes cause a loss in critical electrode alloy constituents. If a short arc length is not maintained, excessive spatter may result in some cases. The large fluid pool characteristic of CO_2 processes is sometimes difficult to control.

A trade-marked metal transfer process called "Dip Transfer" was developed by Air Reduction Co. to prevent these difficulties, *Fig.* 11. With Dip Transfer, metal is transferred entirely by a wiping action at a time of short circuit, rather than being projected through an arc stream, *Fig.* 12. The short circuits caused by the electrode dipping into the weld pool occur at a steady rate as high as 200 per second. The power supply must have a value of inductance that will properly regulate the rate of rise and decay of the current.

The moving electrode comes in contact with the pool, creating a short-circuit load on the power supply which causes the current to surge upward toward a very high value. However, before this electrical surge reaches its maximum peak, overheating is caused by resistance to the flow of current at the point where the electrode enters the weld pool. Surface tension causes the metal to be wiped off the electrode and shortly thereafter—with an assist from electromagnetic pinch effect—the contact is broken and a relatively high current arc is established. This sequence results in metal transfer without spatter.

The energy from the arc melts the electrode and keeps the weld pool fluid. The arc develops considerable force which creates a depression in the weld pool. As the energy from the inductor is discharged to the arc, three things occur—the voltage and current decay, the forces on the weld pool decrease and the melting electrode advances toward the work. Arc length therefore decreases. Finally, the electrode and the pool again come in contact, the liquid drop is transferred to the pool, and the cycle repeats.

If the inductance of the circuit is too low, spatter results. If the inductance is too high, the arc fluctuates and is difficult to control.

Other factors enter into the determination of this uniform cycle—electrode wire diameter, the electrode extension (distance between the gun and arc) and the rate at which the electrode is fed into the arc. The correct correlation of all these elements regulates weld quality. With correct correlations metal transfer is close to 95 percent.

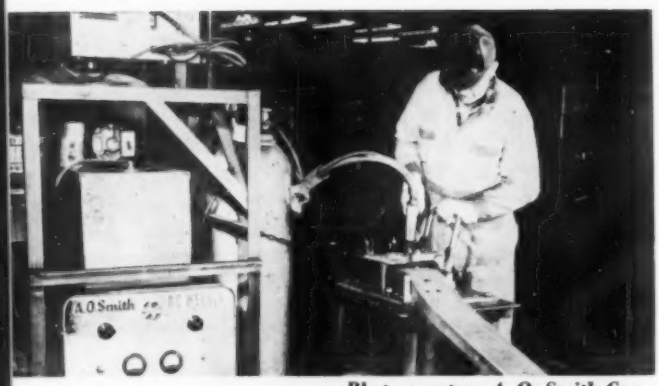
Dip Transfer is most practical at current levels below 200 amperes. These currents are most compatible with fine diameter wires, preferably less than 0.045 inch. With fine wire and reduced energy input the size of the weld pool remains small and is easily managed, making all-position welding practical. When wires larger than 0.045 inch are used current levels are not sufficiently high to give stable metal transfer. The result is an arc difficult, if not impossible, for an operator to manipulate.

Dip Transfer is particularly well suited to welding sheet 0.253 inch and smaller. However, it is not confined to thin section. Heavier sections can be welded since deposition rates as high as six pounds per hour have been achieved in the vertical position using small diameter wires with the average currents approaching 200 amp.

Dual Shield Process: Another process designed to circumvent disadvantages encountered in CO_2 welding is the "Dual Shield" process, developed by National Cylinder Gas Div. of Chemetron Corp. A flux-cored electrode in conjunction with a CO_2 shield prevents excessive spatter and provides a stable arc. Success in using the process depends on proper electrode selection. Several types have been developed to suit all common applications.

—Photo courtesy Air Reduction Sales Co.

Fig. 8. Inert-gas metal-arc portable gun is used to join cast aluminum corners of refrigerator truck roofs. Argon is used as shielding gas.



—Photo courtesy A. O. Smith Corp.

Fig. 9. Hand-operated CO_2 welding gun being used to make "spot" welds.

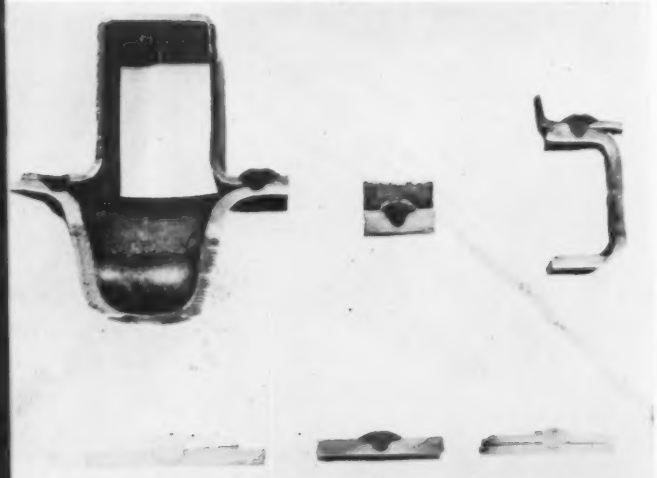
Application: The main success of Dual Shield welding has been exhibited when it has been substituted for stick electrodes to weld mild steel. Advantages over stick electrodes which have been noted are: welding speed is higher, distortion is lower, penetration is better and less time is spent on surface and edge preparation.

An example of improvement in welding operations by substitution of flux-cored electrodes for stick type is the construction of snowplow mold board assemblies at Gledhill Road Machinery Co., *Fig.* 13. The assemblies were formerly welded with $\frac{7}{32}$-inch diameter iron powder stick electrodes. Fillet welds were completed in one pass in 0.10 to 0.20 carbon mild steel $\frac{1}{8}$ to $\frac{3}{4}$ inch thick. Time required to complete one mold board, *Fig.* 14, was two hours and fifty minutes.

By using $\frac{5}{64}$-inch flux-cored electrodes with CO_2 shielding, welding cost for each board has been cut 66 percent. Equipment consists of a 500-amp power source, a control unit and a manual welding gun which feeds electrode automatically.

Approximately ten hours were required by the welder to experiment with the equipment to obtain efficiency. Previous welding experience of the oprator was limited to stick electrode work.

Reports from field use confirm expectation of good weld-metal ductility. All welds are exposed to view so appearance is important. Process has proved highly satisfactory from this standpoint.



—Photo courtesy A. O. Smith Corp.

Fig. 10. Cross sections of welds made with CO_2 spot-welding gun. Proper timing of weld cycle insures good weld penetration.

Aluminum Welding: Two commonly occurring difficulties in inert gas welding of aluminum are presence of dross and porosity in welds. Dross is caused by oxygen. The source of oxygen may be from air or oxygen may be introduced as aluminum oxide, a hydroxide or moisture.

—Photo courtesy Air Reduction Sales Co.

Fig. 11. (right) Operator welds inside of air-filter housing with Dip Transfer CO_2 welding process.

Most porosity is caused by hydrogen. The chief source is the surface of the weld wire. Other sources are the base metal, contaminated shielded gas, contamination through the contact tube and moisture in the shielding gas.

Three processes to counteract dross and porosity have been developed by Kaiser Aluminum. The Qualiweld process uses a trace of chlorine with argon or helium through the contact tube with normal shielding in the outer cup. This process is primarily for code welding.

The Econoweld process involves introduction of low-volume flow of argon through the contact tube. Nitrogen is used as the outer shielding gas. This method is the lower in cost but is limited in alloy application.

The Clorecon process entails use of a low-volume flow of inert gas containing chlorine through the contact tube with a low flow of argon or helium in the outer shield. This process is applicable to non-code welding of all aluminum alloy materials.

Pressure Welding

Pressure welding processes are dependent either entirely or in part upon pressure in bringing about coalescence of the metal surfaces. In pressure welding, additional energy for producing coalescence may be supplied in many different ways. The most common of these is resistance heating of the metals to be joined. Being one of the most widely used production welding techniques, resistance welding is a prime target for improvement and modification. Many advances have been made which are currently being employed with highly successful results.

The primary goals for improvement of pressure welding can be outlined as follows:

1. Short weld time
2. Shallower penetration to maintain strength
3. Quick pressure application follow-up after surface fusion
4. Adequately joining materials difficult to weld
5. Lower energy input
6. Elimination or reduction of finishing operations
7. Fewer machinery variables to obtain weld consistency

In all cases of newly developed processes, attainment of one or more of these goals have been achieved. For example, the application of high-frequency current to resistance welding has resulted in development of a process in which extraordinarily high welding speeds can be attained.

When two electrical contacts are placed on a sheet of metal and 60-cycle voltage is applied, a current will flow in a uniformly distributed manner depend-

—Data courtesy Air Reduction Sales Co.

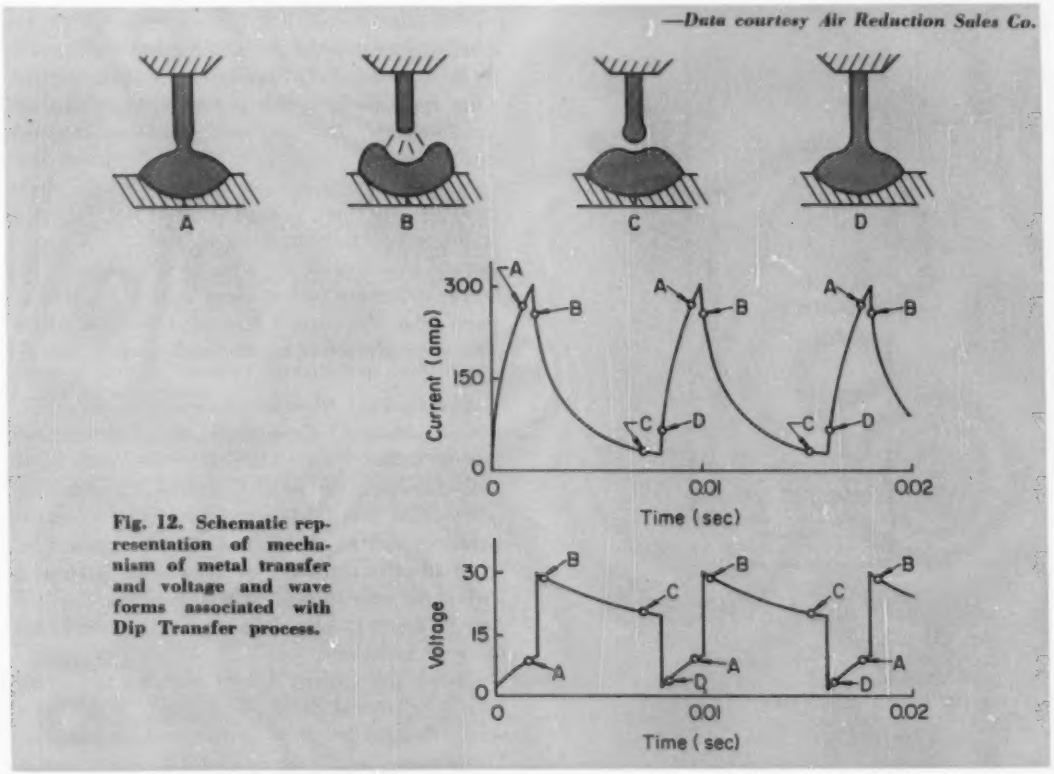


Fig. 12. Schematic representation of mechanism of metal transfer and voltage and wave forms associated with Dip Transfer process.

—Photos courtesy National Cylinder Gas Div., Chemetron Corp.

Fig. 13. Welding snowplow mold boards with manual gun using flux-cored electrode and CO_2 as shield.

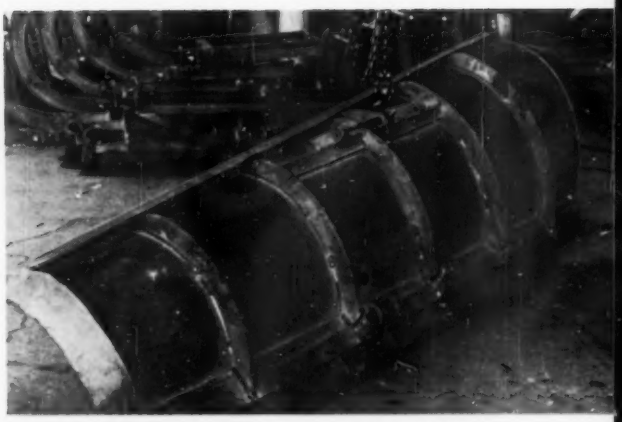


Fig. 14. Completed mold board. Fillet welds are made in one pass in low carbon steel.

—Data courtesy New Rochelle Tool Corp.

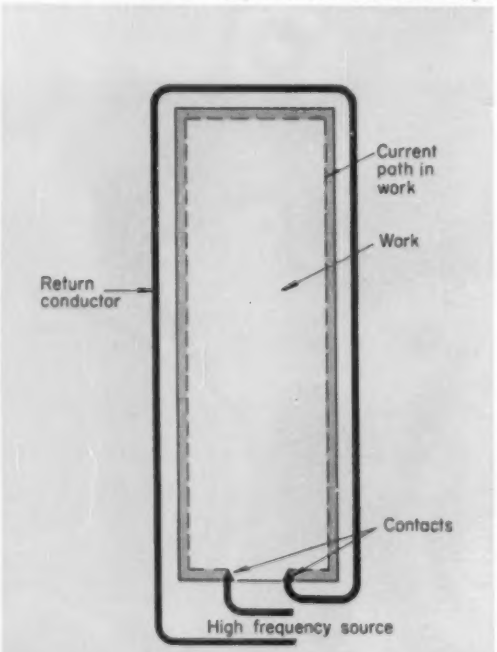


Fig. 15. Principle of high-frequency heating. High-frequency current tends to follow the path of least inductance. This path is normally the one which is closest to the return conductor.

ing on the resistivity of the workpiece. If a high-frequency voltage is applied through these contacts, the current will not flow over the path of least resistance, but rather most of the current will flow over a path of least inductance. It is possible to have a large part of the current flow over a path a considerable distance from the contacts. The low inductance path is normally the path which is closest to the return conductor of the circuit, *Fig.* 15.

This characteristic of high-frequency current has been applied to resistance welding by New Rochelle Tool Corp. in their Thermatool welding method. First applications of this process were in tube and strip welding. The tube welding process is shown in *Fig.* 16.

Sliding contacts are placed on each side of the unwelded opening. Voltage at about 400,000 cycles is introduced through these contacts. A V-gap is formed by edges of the strip as it is closed. The lowest inductance path is along these edges, thus almost all of the current flow is at the skin of the strip edge just preceding the weld point.

Advantages: High welding speeds are attainable with this method. For example, 6⅝ inch diameter pipe is welded from ¼-inch hot-rolled plate at 45 fpm. Thin strip can be mash welded at speeds from 500 to 1000 fpm. Surface conditions where contacts introduce current of the metal are unimportant because effective resistance of the surface is reduced by lowered scale impedance at high frequency. It is only necessary to have clean metal at the joined edge to avoid inclusions.

Three-phase current is used reducing the investment in electrical service equipment. Welds have very little bead due to the narrow heat-affected zone. The process is applicable to a large variety of metals

such as aluminum, brass, copper, stainless steel and monel. Titanium and zirconium and their alloys have been successfully welded with suitable shielding. Many different shapes can be welded, *Fig.* 17.

Spiral Welding: A spiral mill has been developed by New Rochelle to form spirally welded tubing from thin strip, *Fig.* 18. The strip is fed at an angle to a revolving mandrel and mash welded. By changing mandrel diameter and feed angle a number of different sizes can be formed. Tubing can be made in this mill at the rate of 60 to 70 feet of tube per minute or more.

Magnetic-Force Welding

Of prime consideration in resistance welding is follow-up time. A means of synchronizing the electrode force with current duration and magnitude has been achieved with development of a magnetic-force welder by Precision Welder and Flexopress Corp. Work is positioned in the welder and held with a slight pressure exerted by means of an air cylinder. The final forging pressure is exerted by electromagnets in the welding circuit. The forging stroke can be delayed for welding some combinations of metals which need a longer time to reach forging temperature.

Magnetic-force welding is used for high conductivity metals such as are used in electrical contacts. It has been applied to welding of vinyl-covered steel successfully on many different products.

Foil Seam Welding

Developed in Europe, the foil seam-welding process for making butt seam joints is exclusively licensed in this country to Precision Welder and Flexopress Corp. In the process, *Fig.* 19, thin foil is placed on the top and bottom surfaces of joint to be butt welded. The strips are from 0.007 to 0.010 inch thick. The function of the foil is to act as a bridge to distribute welding current to both sheets and prevent too rapid withdrawal of heat from the joint area. The foil does not provide filler metal.

Advantages are high-speed operation and production of a weld which requires little or no finishing. The weld can be painted or glass lined without subsequent grinding. Since welded sheet can be used as stock in a punch press without dressing the weld, small scrap sheet can be reclaimed economically.

Ultrasonic Welding

Metal surfaces may be welded by the application of ultrasonic mechanical energy. The shear vibrations are introduced which produce a weld with a solid-state metallurgical bond over half its width. The remainder is a mechanical bond. Both spot and continuous seam welding can be accomplished with commercially available equipment. Metals difficult to weld by some conventional processes can be

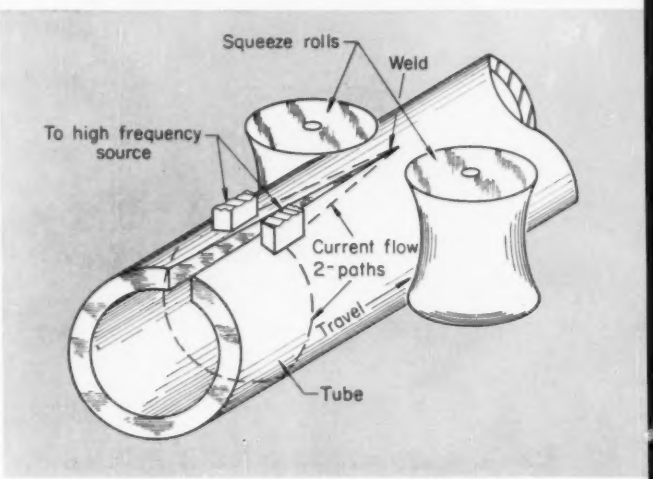
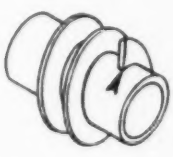


Fig. 16. (right) Welding tube by high-frequency resistance method. Most of current flow is in V-gap formed as tube closes.

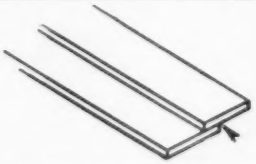
—Data courtesy New Rochelle Tool Corp.

—Drawing courtesy New Rochelle Tool Corp.

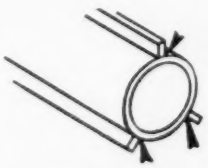
Fig. 17 (below) Examples of products that can be welded by the high-frequency resistance method.



Spiral fins continuously welded to tube for heat exchangers.



Continuous lap or mashed lap welding of strip. Typical use — producing wider sheets or differential metals.



Longitudinal fins or ribs continuously welded to tube (atomic reactors, heat exchangers).

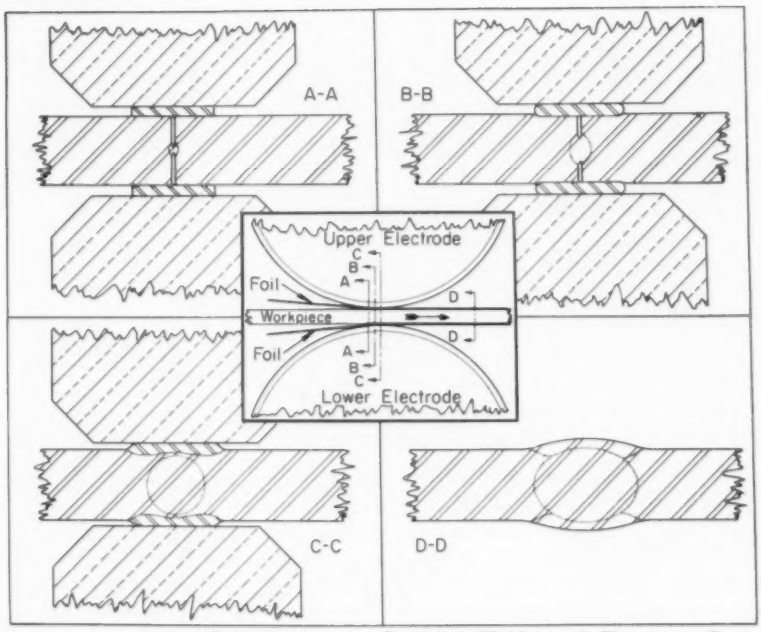
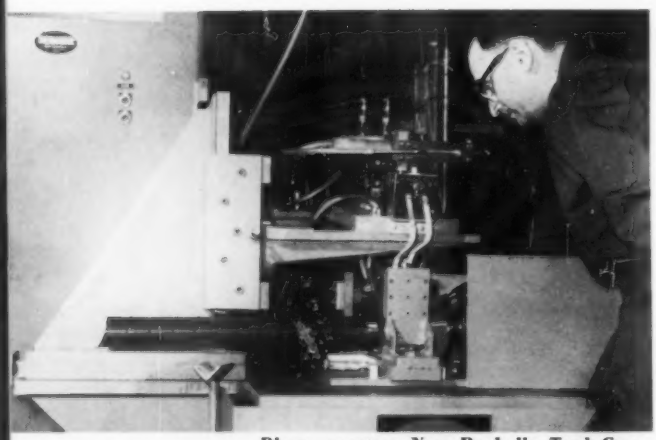


Fig. 19. Foil seam welding. Nugget grows as shown.

Fig. 18. (below) Spiral mill for welding tubing. Various diameters can be formed by changing mandrel size and feed angle.

—Drawing courtesy Precision Welder and Flexopress Corp.



—Photo courtesy New Rochelle Tool Corp.

joined with ultrasonic methods. These include stainless steel, molybdenum, zirconium, tantalum and titanium. Various types of bimetal combinations can be joined.

The most extensive application of ultrasonic welding is joining foil or sheet gage aluminum. Strong welds can be formed since there exists no low-strength cast or heat-affected zones. There appears to be no practical limit to the minimum thickness of aluminum that can be welded. Maximum thicknesses that can be welded are about 0.080 inch for high-strength aluminum alloys and 0.120 inch for soft alloys. However, thin stock can be welded to any thickness and layers of foil can be welded.

Summary

Welding today truly wears a new look. New processes are being developed to solve welding problems essentially as soon as they develop. Equipment development to utilize the new methods to the fullest extent is following close behind. Some of the processes discussed here have been applied widely; some have not yet begun to reach their full potential. All will benefit the tool and manufacturing engineer in reaching goals of efficient economical production.

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Chemetron Corp. .....New York, N. Y.
Miller Electric Mfg. Co., Inc.....Appleton, Wis.
Kaiser Aluminum & Chemical Corp.....Chicago, Ill.
New Rochelle Tool Corp.....New Rochelle, N. Y.
Precision Welder and Flexopress Corp.....Cincinnati, Ohio

ASTE news

tool show exhibitors sound off!

GIVEN THE CHANCE to display their views as well as their wares, ASTE Tool Show exhibitors have showed themselves to be fully aware of and concerned with the problems that face American manufacturers today.

The chance to sound off came when a questionnaire was sent out to each firm that purchased floor space at the ASTE Tool Show to be held in Detroit next April 21-28. Results of the survey indicate not only an awareness of the problems, but also an eagerness to offer solutions.

Along with requests for a summary of the types and number of products that the exhibitor would be showing in his booth at the big Armory in the Motor City, two questions were posed concerning the general economic outlook in the United States.

- What do you believe are the major problems facing you and your customers, as businessmen, today?
- What do you think can be done about these problems?

Some respondents felt there wasn't enough time or space to even begin to express their ideas on the subject. Others set down their thoughts in brief essays of a hundred words or so.

One exhibitor had plenty of room to say all he wanted to say in one anguished utterance—"Taxes. Taxes. Taxes."

Most of the poll's participants agreed that the major factors inhibiting our economic progress are foreign competition, unfavorable depreciation allowances, inflation, labor or union difficulties, too much or too little government regulation of business, and lack of investment capital.

A suggested remedy for the dangers arising from foreign competition was offered by one exhibitor in these words: "Perhaps a 'patriotic' evaluation of this situation would help—government, unions, and management all working hand in hand to emphasize 'Buy American.' Easing of business controls, cost-reduction programs, elimination of excess profits, and stabilization of wages and fringe benefits will all help to make the U.S. competitive in world trade and remain as the leader in world industry."

Another manufacturer, directing a broadside at tax depreciation allowances, deplored the government's "tendency to control business" and declared, "It is far healthier to pay people for working than to pay them unemployment insurance."

A number of things came under fire from one exhibitor. His statements were curt. "So-called tight money policies (on again—off again) leaves investors fearful. Possible unfair market brought on by our businesses establishing themselves abroad, and then pressuring for tariff concessions. The big boys can accomplish it. No end to inflation."

Are American manufacturers really so far advanced? One man thought not. "The major problem facing us is the fact that too many presumably 'on their toes' in modern plants still use obsolete methods."

One respondent summed up the great expectations of many exhibitors—despite the challenges and doubts that beset them—by saying simply, "We are really very optimistic, and we foresee no problems."

Even those who are inclined to view with alarm must secretly share that respondent's faith in the future of American industry. Their participation in the ASTE's Tool Show is testimony to their faith.

Members Vote on Addition to Name

Qualified voting members of ASTE are deciding whether they want to ring out the old and ring in the new—whether they want to dispense with ASTE and make it ASTME.

Just before Christmas ASTE members received a referendum ballot on the proposal to add "and Manufacturing" to the Society's title. Along with the ballot they got material explaining the reasoning behind the move to rename their organization the American Society of Tool and Manufacturing Engineers.

Ballots should be marked yes or no and returned to the Executive Secretary, ASTE Headquarters, within 30 days. For the voter's convenience, a return envelope was included.

Final approval or disapproval of the addition to the name will be decided by a *majority of the votes cast* by the 40,000 members.

The constitutional machinery which set up the referendum started with the filing of required petitions from qualified members. Then the ASTME proposal won majority approval of *all* chapter Constitution and Bylaws committees in balloting last month.

ASTE helps PRISONERS

by M. L. Stone, news editor

TWO EVENINGS a week, month after month, two-man teams of tool engineers drive 40 miles up into the mauve mountains from Tucson, up where the eagles teach their young to fly, and there they help the Federal Bureau of Prisons teach humanity's young to keep both feet on the ground.

Eight members of ASTE Chapter 106, along with eight more who are alternates for substitution, conduct machine shop classes at the Mt. Lemmon federal prison camp in Arizona's Santa Catalina mountains.

Camp Superintendent Walter W. Fitzpatrick, a cheerfully dedicated Irishman whose long experience with the toughness of lives has only served to bring out the tenderness in his own, is enthusiastic about the ASTE's contribution to progressive penology.

"It's a new experience for some of the boys, to see these men 'doing time' up here with them simply because they want to," Fitzpatrick declared.

"The therapeutic effect on wayward boys when they realize that someone really cares about them is perhaps even more important than learning a trade. Just knowing that these ASTE men are giving their time and talent to help them goes a long way toward renewing their faith in society and in themselves."

The ASTE volunteers teach general machine shop practices, safety, use, care and maintenance of power tools in a scheduled program under the direction of James F. Robinson, a young Missourian who is simultaneously a family man, the camp's supervisor of vocational training, and a candidate for a doctor's degree at the University of Arizona in Tucson. Machine shop classes, which are held from 6:30 to 8:20 p.m. every Monday and Thursday, are only one facet of a vocational and academic program that ranges from literature to welding. Every youth in the camp is considered to be an on-the-job trainee.

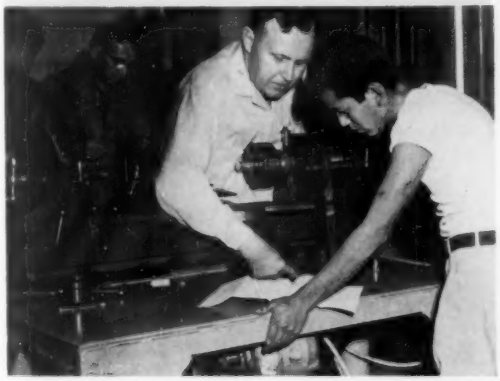
The tool engineers are the only organized group that has offered such direct and personalized help. Their contribution isn't always confined to the classroom either. Recently they got Fitzpatrick's permission to take a talented but intractable boy outside the prison gate, down into town.

When the youth left with them that evening, he was a camp problem—surly, silent, disinterested.

The tool engineers took him to one of their meetings. He heard a solid talk that pointed to the challenges of manufacturing engineering; he made friends, had a good dinner in one of Tucson's most brightly lighted places, and came back to camp a different boy.

"He came back motivated," Fitzpatrick said. "He proceeded to learn everything we could teach him, and it wasn't long before he won a parole."

Only the superintendent himself, with his sentimentality ill-concealed under an urbane exterior, could have been more proud than the tool engineers when the Mt. Lemmon ball team recently brought home the City of Tucson's sportsmanship trophy for the second year in a row. That they failed to win the big games in their tournament with the



Shop scenes at Mt. Lemmon federal prison camp show tool engineers working with inmates. Top is Harry McClain with a young micrometer reader. At bottom, with lathe operators, are (foreground) Neal Waisanen and (background) William Helsper.

various other teams in the metropolitan area of 250,000 was not important; that they showed evidence of maturity and self-control was the heart of the matter.

Inevitably, some close friendships between tool engineers and inmates have arisen during their weeks of working together.

No Better, No Worse—Just Unluckier

"These boys are no different from any others," said Harry DeLong, who fostered the chapter's big brother role while he was its chairman last year. "They're no better, no worse; no smarter, no dumber. Just unluckier than most. They're not delinquents. They just come from delinquent homes and a delinquent society."

The seed of the project was planted by James Burch, a nonmember who soon became one when he saw ASTE in action. DeLong told his Advisory Council of past chairmen about Mt. Lemmon's change-over from an adult detention camp to an experiment in youth rehabilitation, and called for help.

The Tucson chapter already had a notable record of community and civic achievement, including volunteer technical help on a satellite-tracking project and evaluation studies of a proposed new industry for the area. It needed no further urging.

Shortly after DeLong's plea, a group led by Past Chairman Jim Beach drove out through the dude ranches and the cactus foothills one evening, up past the timberline to the neat swinging gate of the camp. There they offered their good-will and know-how to the prison's staff.

Their offer was accepted with alacrity.

Those regularly teaching at Mt. Lemmon now include Harry E. McClain and John Oberteuffer, who are past chapter chairmen; Wilbur Hoffman, Charles Seeger, William Helsper, Howard Larcum, Harry Moore and Neal Waisanen. On the roll as alternates are Ted Kresler, Chairman J. Clark Pierce, Ed Randall, Les Arndt, Ed Sallee, William Bean, Seymour Jacobson and Ralph May. Communications and scheduling are no problem because the men—in fact, a majority of the whole chapter's membership—work in the same plant, the sprawling missile facility of the Hughes Aircraft Co.

One of the volunteers' first acts was to send a troubleshooting delegation out one Saturday early last year to overhaul the shop's machines. It was open house for ASTE at the camp that day. The tool engineers got acquainted, ate prison chow, sized up the challenge—and worked. They put the surplus machines, some of which were inoperative for lack of parts, into working order and cooperated with Jim Robinson in setting up the class schedules.

Classes are limited to eight youths, because of lack of equipment. Robinson and his ASTE teams would especially like to have a milling machine and four new lathes for replacements. Although the shop has five lathes now, four of them are as old as giant saguaros. A recent acquisition from federal surplus sources was a 7-in. shaper.

The shop itself is housed in a 6000-square-foot building of good design and workmanship which was erected entirely by the youths under the occasional supervision of one "professional."

Stone walls abound in the mountain fastnesses of Mt. Lemmon, but they do not a prison make. There's unfettered space and inspiration for the mind, at least; and the only limits on physical freedom are spacious boundaries outlined by whitewashed stone markers. There are no bars, no fences, no physical discipline—no locks except on the youths' lockers and on storerooms.

The camp is in fact unique among the 30 institutions in the federal prison system, Fitzpatrick said. Converted in 1956 and 1957 from an adult wetback prison to a youth facility (in penal parlance, a "youth" is a person sentenced under the Youth Act, age 17 to the early 20's), the Mt. Lemmon camp has graduated from its experimental status into a fully recognized, minimum-security rehabilitation center. Now it is being considered as a pattern for other such camps.

The Mt. Lemmon way of life is based on the premise of progressive penology that a convict is sent to prison for treatment rather than as retribution or expiation for sins against society. To be accepted for admission, a youth must first demonstrate his fitness for minimum security and readiness for rehabilitation through encouragement, training, and fair and impartial discipline.

"Many boys come here from backgrounds of broken homes and economic depravity, with an ingrained urge to 'beat the system.' But they find there is no system here," Fitzpatrick said.

Example of Total Rehabilitation

Total rehabilitation is the ideal toward which the staff aspires. There has been at least one example.

One youth of special mechanical inclinations was sent to summer school at the University of Arizona. The prison dressed the young man in unostentatious sports clothes and furnished his transportation down to the campus each class day. He made the grade. In the fall he was paroled, and admitted to the university as a full-time engineering student.

Even after a full day's work at their regular jobs, and after the tortuous drive up the mountain road and two hours of classroom concentration, the tool engineers still confess to a twinge of regret when the 8:20 whistle signals that class is dismissed.

Luckily, though, the "growing boys" of Mt. Lemmon get four high-protein meals a day, so sometimes the tool engineers stick around and share cereal and coffee "snack time" with them at 8:30.

18 candidates chosen for board of directors

The Annual Nominating Committee is submitting the following list of candidates for the Board of Directors, sincerely believing that all are qualified to make the policy decisions necessary to guide our Society:

H. Dale Long	William Moreland	David A. Schrom
Irving H. Buck	Arthur Cervenka	Verne Loeppert
Philip R. Marsilius	G. Ben Berlien	Leslie Seager
Frank F. Ford	Francis J. Sehn	Joseph L. Petz
Wilfred Pender	Charles M. Smillie	Dean Saurenman
Edward Wheeler	Duane Brighton	Sam L. Grasso

The qualifications of these men were measured very critically. The factors considered included: Interest and enthusiasm for ASTE; company and family approval of the time necessary to be devoted to serving as a board member; independence of thought and sound business judgment. Some of the other attributes were financial training and management experience.

Each of the nominees was judged on his length of service in national activities; ability to analyze complex Society operations; and ability to express himself. After correspondence and individual investigation, the Nominating Committee met at National Headquarters in Detroit on Aug. 29.

On Nov. 19 we were notified by Bruce Fairgrieve that he wished to withdraw his name due to business reasons. Due to the short period of time remaining before the deadline to go to press a telephone conference was arranged for Nov. 23. The Nominating Committee felt that there was not sufficient time to analyze the qualifications of additional Canadian members and therefore decided to break the precedent—for this year only—of formally nominating a Canadian candidate for the board.

Respectfully submitted,
The 1959 Nominating Committee

The House of Delegates will elect 14 national directors at the next Annual Meeting, to be held in Detroit in April. The retiring president, Wayne Ewing, automatically becomes the 15th director. Candidates for election are:

H. Dale Long, ASTE first vice president, is now serving his fifth term as director. President and chairman of the board at Scully-Jones & Co., Chicago, and chairman of the board of Scully-Anthony Corp., Long has moved up through the ASTE officer ranks in successive years and has also headed the National Finance Committee. He is a past chairman of Chicago chapter. A University of Illinois graduate, he is also active in management associations.

A national director for three terms, **William Moreland** is currently chairman of the Director Nominating Committee. He is also national second vice president, a position he filled after completing terms as third and fourth vice president and secretary. The National Standards Committee, on which he served for ten years, claimed him as both its chairman and vice chairman. Originally with the Rockford chapter, of which he is a past chairman, he was also an officer of the Detroit chapter for a time, but he is now a charter member of the Mansfield ASTE group. At various times he has served on the name-change, officer nominating, progress, and policy coordinating committees. Vice president in charge of manufacturing at F. E. Myers & Bro. Co., Ashland, Ohio, Moreland also belongs to the Research Institute of America, and the American Management Association.

At present third vice president, **David A. Schrom,** works manager at the York Div. of Borg-Warner Corp., York, Pa., also served as fourth vice president and secretary of ASTE. A past chairman of the York chapter, he has worked on the national level as vice chairman of the Public Relations and Technical Publications committees. The Editorial, Progress, Constitution and ByLaws, Education, and Professional Development committees have also benefited from his membership, the latter three in an ex-officio capacity. In 1957 and '58 Schrom was chairman of Project Revisions #9 ASTE Handbook. A registered professional engineer in the state of Pennsylvania, Schrom began working at York before his graduation from Penn State with an industrial engineering degree. The year 1954 saw his retirement from the U.S. Navy with the rank of lieutenant.

As a result of his four years on the National Membership Committee, part of the time as vice chairman and area captain, **Irving H. Buck,** a director since 1955, was instrumental in the formation of several ASTE chapters in the southwest United States. He is board chairman of the Tool Supply and Engineering Co. of Dallas, and president of Machine Tool Sales Co. A three-time chairman of the North Texas chapter, he was also a charter member of that group. Buck is the president of the North Texas Industrial Distributors Association, and is on the board of the Great Southwest Life Insurance Co. Besides belonging to the Engineers Club of Dallas, he is also a member of the American Machine Tool Distributors Association and the Chamber of Commerce.

H. Verne Loeppert, national secretary, is a past chairman of the Chicago ASTE chapter. He also held the offices of vice chairman and treasurer. Vice president of the Boyd-Wagner Co. of Chicago, Loeppert joined the Society in 1946. He was appointed to the National Membership Committee in 1951 and held the post of chairman from 1955 until 1957. From '57 to '58 he was on the National Finance Committee. When the Annual Meeting and Tool Show was held in 1956, Loeppert headed the Host Committee. Educated at Northwestern University, the University of Houston, and the University of Chicago, from which he has a master's in business administration, he is a registered professional engineer in the state of Illinois and a commander in the U. S. Naval Air Reserve. Loeppert is also a vice president and director of the Illinois Engineering Council.

A member of the Nebraska ASTE chapter, **Sam L. Grasso** has served that group in the capacities of first vice chairman, chairman and national delegate. He has been connected with the National Membership Committee as area lieutenant, area captain and vice chairman. The vice president of both Inland Mfg. Co. and Inland Automatic, Inc., Omaha, Grasso is a national director for the American Society of Quality Control. He is also a member of the industrial committee of the Omaha Chamber of Commerce. An alumnus of the Industrial War College, Washington, D. C., Grasso has completed a course in industrial relations at Creighton University in Omaha.

Leslie C. Seager is in his fourth year as a national director. He was one of the organizers of the Salt Lake City chapter, chartered in 1950. Among the many offices he held in the chapter was that of chairman. Chief production engineer at Eimco Corp. in Salt Lake City, Seager served for four years on the National Professional Development Committee, one year as chairman. He was instrumental in the establishment of a four-year tool engineering curriculum at Westminster College and Utah State University. In an effort to coordinate engineering education with the needs of industry, Seager worked with the Utah Engineering Council. He is also affiliated with the American Ordnance Association and the British Institution of Production Engineers.

18 candidates chosen

An incumbent national director, **G. Ben Berlien** was on the National Editorial Committee for three years. One of those years he served as chairman. He was also a member of the Annual Nominating Committee in 1955, 1957 and 1959. Berlien is a partner in the Industrial Steel Treating Co. of Oakland, Calif. His affiliation with the Golden Gate chapter was highlighted by his term as chairman of the group. Besides ASTE, he is associated with the American Society for Metals, having been a chairman of the ASM Golden Gate chapter. He has lectured before more than a hundred chapters of both societies, and his byline has appeared more than a few times in a number of metalworking publications.

A member of the National Program Committee since 1957, **Edward H. Wheeler** is now that group's chairman. With the Standard Pressed Steel Co. of Jenkintown, Pa., for 24 years, Wheeler worked his way up to his present position as manufacturing division manager. He is currently the head of the Middle Atlantic States Regional Council of ASTE chapters. As general chairman he oversaw the activities of the host committee when the ASTE Tool Show and Convention was held in Philadelphia in 1958, and was cochairman of that activity in 1954. Besides various committee chairmanships, he also served as chapter chairman and national delegate for Philadelphia Chapter 15. He holds active membership in the American Society of Mechanical Engineers. Wheeler was educated at the Drexel Institute of Technology and Penn State University Extension.

ASTE's fourth vice president and past national treasurer is **Philip R. Marsilius.** Fulfilling his fourth term on the Board of Directors, he worked on the National Program Committee for three years, one of them as chairman. Marsilius is executive vice president of the Producto Machine Co., Bridgeport, Conn. He was at one time tool and die industry adviser to the Metalworking Equipment Div. of National Production Authority, Washington. A past chairman of the Fairfield County chapter, he held several other offices in that same group. He is past president of the National Tool and Die Manufacturers Association, and is now a member of the Business and Defense Executive Reserve, U.S. Department of Commerce. Holding a master's degree from the Massachusetts Institute of Technology, Marsilius devotes his spare time to participation in civic activities.

Chairman of the National Finance Committee, **Duane H. Brighton** works as machine tool supervisor at the Caterpillar Tractor Co. in Illinois. A member of the Peoria chapter, for which he was the chairman during the 1951 and '52 term, he was the national delegate in 1952 and '53 and the student chapter adviser in 1953 and '54. Brighton has served on two national committees. He has served seven years on the National Finance Committee, for which he was twice vice chairman, and the National Nominating Committee. He was chairman of the Seventh Annual Tool Engineering Conference for Illinois chapters. An alumnus of Bradley University, he also completed a four-year machinist apprentice course sponsored by his employer. His civic activities include his participation in membership and fund-raising drives for the Peoria YMCA.

Chairman of the National Technical Publications Committee for six years, **Francis J. Sehn** also filled posts on the Annual Nominating and the National Standards committees. A member of the faculty at Detroit's Wayne State University, Sehn is the owner of The Fran Sehn Co., a consulting engineering firm, and is president of Press Automation Systems, Inc. He is a member of the American Standards Association's B-32 sectional committee on Sheet Metal and Wire Standards and represents ASTE on the Honor Award Committee of the Pressed Metal Institute. During World War II Sehn served on the machine tool division of the War Production Board. A registered professional engineer, he is a member of the Society of Automotive Engineers and the Engineering Society of Detroit.

18 candidates chosen

Present chairman of the National Constitution and Bylaws Committee, **Arthur Cervenka** is the manager of equipment and process engineering at Grumman Aircraft, Bethpage, L. I. A charter member of the Long Island chapter, he served the group as chapter chairman, national delegate and as head of numerous chapter committees. Cervenka holds a B.S. in mechanical engineering from Columbia University. He has headed the American Standards Association's Committee for Accuracy of Machine Tools. He is presently chairman of Aerospace Industries Association's Manufacturing Engineering Committee.

Now serving his fourth term on the National Board of Directors is **Joseph L. Petz.** Three of his seven years with the National Editorial Committee were spent as chairman. Known throughout the New England area for his service to the Society, he is specifically connected with the Mid-Hudson chapter of which he is a past chairman. Petz is the secretary-treasurer of both the J. L. Petz Co. and Petz-Emery, Inc. The businesses are located in Pleasant Valley, N. Y. A member of the American Society for Metals, Petz spent a total of 12 years teaching the theory of tool design to IBM apprentices and also in the IBM General Education evening school. He has been connected with the Boy Scouts of America since 1913.

A director for two terms, **Frank F. Ford** is a partner of Ford-Lynch Associates. Since 1949, he has founded and directed the development of three different organizations—Frank F. Ford and Associates, Ford Supply Co. and Dixie Engineering and Manufacturing Co. His activities with the Atlanta chapter culminated in his chairmanship of that group in 1952. A metallurgy graduate from Yale University and registered professional engineer, Ford was at one time associate professor of chemical engineering at Georgia Tech. He is a member of ASM, serving that society as a national delegate and as a member of the National Nominating Committee. He is also connected with the Georgia Engineering Society and the American Welding Society.

Completing his first term as a national director is **Dean Saurenman.** Besides the chairmanship he held all other offices in the Houston chapter except that of secretary. He has been with the Houston group since 1940. An associate development engineer for the Schlumberger Well Surveying Co., Saurenman headed the plant tour committee for the Annual Meeting held in Houston in 1947. When the ASTE convention came back to that city in 1957, he was a subchairman of the host group. He served three years on the National Standards Committee and one on the Editorial Committee. Affiliated with the American Society for Metals for 20 years, Saurenman was graduated from the California Institute of Technology.

Completing his fifth year on the Board is the ASTE national treasurer, **Charles M. Smillie.** President of the C. M. Smillie Co. of Ferndale, Mich., he helped organize and became the first chairman of the Professional Engineering Committee in 1952, staying with the group until 1956. Smillie also served on the National Membership, the Name-Change and the Officer Nominating committees. Among other offices he held that of chairman of the Detroit chapter. His aid was also given in the organization of ASTE student chapters. A past chairman of the Michigan District of National Screw Machine Product Association, Smillie has since 1955 been the head of the State Advisory Council of Scientists and Engineers of the Selective Service.

Wilfred J. Pender has twice been a member of the Board of Directors. He also served on the National Constitution and Bylaws Committee. Formerly with the Potter & Johnston Co. of Pawtucket, R. I., since 1923, he was that firm's vice president and factory manager. He is now connected with Pratt & Whitney Co. of Hartford. A member of the Little Rhody chapter, Pender headed practically every one of the group's committees and was also chapter chairman in 1947. He attended the Rhode Island School of Design and completed a course in the International Correspondence School. Pender is active with the Pawtucket Chamber of Commerce and also serves on the advisory committee for tool engineers in connection with the University of Rhode Island.

On-Campus Roundup:

Canadians Meet At McMaster U.

BOTH THE PHYSICAL LIFE and the tax life of machine tools are distressingly long, registrants to the Second Canadian On-Campus Conference were told.

"Indeed, some people are convinced that machine tools don't die, they just fade away," said William O. Moeser of the Jones & Lamson Machine Co., Springfield, Vt., who presented one of the four papers at the Oct. 24 conference at McMaster University. The new engineering building on the campus at Hamilton, Ont., which had been formally opened only the day before, was the site of the all-day session on "Planning for Competition" sponsored by the nine Canadian ASTE chapters. Despite teeming skies, over 120 registered.

Although Moeser offered no panacea for the extended tax life of machine tools, other than to urge realistic revision of depreciation policies now administered under the "infamous Bulletin F," he did present a definite formula for replacing machine tools before they become physically senile. Emphasizing the big difference between "useful" equipment and "profitable" equipment, he declared:

"There's a broad field of economic failure lying between new equipment and actual machine breakdown or physical obsolescence. How do you spot economic failure in your shop? Run regular on-the-spot production surveys. Gather information periodically on all your alternatives regarding the equipment in question, then pick the best alternative and hope for the best."

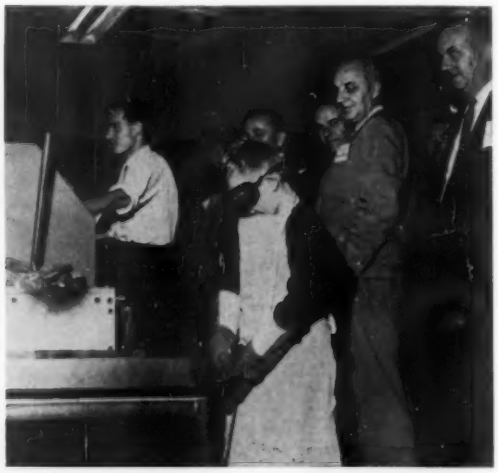
The "avoidable costs" formula has been the most successful that Jones & Lamson has found, Moeser said. Under the formula, a proposed replacement project is analyzed in terms of avoidable costs which would be incurred by postponing the replacement decision for one, five, or ten years. The J&L formula differs from other commonly used prescriptions, Moeser said, in that it does not analyze a replacement project in terms of the rate of return on investment in the new equipment; or the period of time it will take to return the investment; or the time it will take to obtain a favorable cash flow. The J&L method takes into consideration the projected amount of substantial nonrecurring costs beyond the first year, such as rebuilding, retooling, etc., of the old machine. It also projects increases in labor and other costs, and increases in the price of the new equipment.

Moeser gave a whimsical example of an all-too-prevalent policy on machine tool replacement. Recently his company sold a turret lathe to replace a 28-year-old unit. Why was the lathe replaced at age 28? Why not 56? The answer: the operator retired, and the new operator couldn't hold tolerances on the idiosyncratic old machine.

In the question and answer session, the speaker revealed that his company's directors annually set aside 3 percent of every sales dollar—of gross income—as a funded reserve for replacements. This arrangement acts as a hedge against inflation as

Taking a count of registrants at the Canadian On-Campus Conference is William M. Buchanan, Toronto chapter. Buchanan registered upward of 120 for the all-day seminar despite an all-day rain.

Standing before the colorful ceramic mural in the lobby of McMaster University's new engineering building are three key people in the ASTE's conference there: Eric Browne, Toronto, general chairman; Dr. J. W. Hodgins, dean of engineering; and Harry Ward, Hamilton, vice chairman of the conference.



A goggled and gloved seven-year-old drew as much attention from conference registrants as the vacuum melting and casting exhibit where he was "working." Young Steven Petch is the son of Dr. H. E. Petch of the McMaster metallurgical staff, who explained the lab display to touring ASTE members.

well as a ready source of modernization capital, Moeser asserted.

Other papers included: "Metallurgy as It Affects Tool Engineers," by R. C. Stewart of Vanadium Alloy Steels, London; "Optimation—the Economic Effects of Proper Tools," by Harry Conn, chief engineer, Scully-Jones, Chicago; and "The Role of Economic Factors in Manufacturing Management Decisions," by Ralph K. Cowan, market planning director, Chrysler Corp. of Canada, Windsor. Moderators were Howard J. Wright, London; Mike Hollo, Windsor; P. G. Bowman, Grand River; and W. C. Snider, St. Catharines.

Suggesting that the tool engineer should maintain close liaison with the metallurgical engineer in order to benefit from the new materials, Stewart termed the development of alloys as one of the widest frontiers facing technology. To date, he said, about 8000 alloys and 45 of the 76 metallic elements are being used commercially, yet possibilities are almost unlimited. The number of alloys that might be made from even the 45 commercial metals is astronomical. As an example, Stewart said that 148,095, each containing only four metals, are possible from only one percent of the 45 metals.

An afternoon panel discussion of "Tool Engineering and Quality Control" brought together a manager of quality control (A. Underwood, Jr., Ford Motor Co. of Canada, Windsor); a president of a custom stampings firm (D. R. Few, Dafew Mfg., Toronto); a chief inspector (J. A. Sheldon, Massey-Ferguson, Toronto); a project manager (J. Coomber, IBM Corp., Toronto); and a tool engineer (W. E. Durrant, John Bertram & Sons, Dundas, Ont.). The moderator was an industrial consultant and a member of the ASTE National Program Committee, George H. Churchill of Brantford.

One plant's interesting approach to quality control—or to what one panel member lugubriously called "the lack of quality control"—was related by Jack Coomber. At his IBM facility, he said, there are no inspectors; no special incentives other than pride of craftsmanship; no piecework, not even hourly rated wages. The management has simply attempted to make a man responsible for his job. Each operator is his own inspector; there are only "quality auditors" to ascertain if the operator is recording his inspection.

The panel agreed that too often operators *rely* on inspectors to spot bad quality. The group further agreed that quality or lack of quality reflects back on the tool engineer. The tool engineer should track down the weakness and should then have the courage to speak out forcibly to get quality equipment.

Few expressed his and other Canadians' concern over the loss of highly skilled tool and diemakers to U. S. industry and elsewhere.

The conference committee was chairmanned by Eric Browne, Toronto chapter. Vice chairman was Harry Ward, Hamilton. Others included: Percy Bowman, Grand River Valley, treasurer; Mike Hollo and Bert Underwood, Windsor, program chairmen; Nick Erdie, Niagara District, secretary; Bill Buchanan, Toronto, registration; Bill Dawson and George Churchill, Toronto; Ronald J. Tipping, Hamilton; and Dr. J. W. Hodgins of McMaster.

Dean Hodgins, in welcoming the registrants, announced that the university's engineering school had granted its first degree the previous day. Perhaps indicative of the school's high-level orientation, he said, was the fact that the degree was a master's.

ASTE Vice President H. Dale Long demonstrates a rocket model, one of the props used during his talk before a banquet gathering at the Illinois On-Campus Conference. Shown with Long are (left to right) Don Domnick, Chapter 104 chairman; Dr. Neal Bowman, National Association of Manufacturers; Ray R. Eppert, featured banquet speaker; and Francis (Doc) Bowers, general chairman of the conference.

On-Campus Roundup:

Conferees Warned of 'ECONOMIC FALLOUT'

"ASTE AT ITS BEST," is how H. Dale Long, national vice president, described the Ninth Annual Illinois Tool Engineering Conference held at Joliet Junior College. Speaking to a group at the banquet which climaxed the conference, Long reminded the conferees that they were carrying out the real objectives of the Society—the advancement and dissemination of knowledge in tool engineering. He noted that it was Illinois that held the first such conference and that many other states, recognizing the value of such events, followed suit.

Cosponsored by Louis Joliet chapter and Joliet Junior College, the conference was held Oct. 30 and 31. It was attended by some 250 members and wives from the eight Illinois ASTE chapters. In addition to the technical sessions, a program designed to keep the ladies busy was planned.

In his speech Long urged all tool and manufacturing engineers to continue studying new techniques and applying their knowledge so they can meet the production challenge that faces American industry. Referring to the inroads of foreign competition on U. S. markets, the ASTE vice president warned that America's security is at stake.

"History has shown that nations at the top tend to take it easy," Long said. "We as a nation must guard against the same disastrous course of complacency that has brought economic ruin to others." In stressing that foreign competitors are willing to make the effort to learn new methods, he emphasized the continued need for research on the part of American industry. He cited tool engineers as being the key men in the competitive struggle.

The featured speaker of the evening, Ray R. Eppert, president of Burroughs Corp., continued with the theme originated by Long. Eppert explained that American business is imperiled by "fallout" from "economic bomb" testing, just as deadly in its own way as an atomic bomb.

"Fallout from economic bomb testing going on all over the world is a very real threat," he said. "The winds are blowing our way and the target is definitely our business." Eppert cited the three types of economic bombs which spread this fallout. The first is the economic aims clearly stated by Russia and other Communist bloc nations. The impact of the Common European Market and other free world alliances constitutes the second. And the final type is the narrowing profit margins and limited surplus funds for reinvestment in U. S. business, plus ever-rising material and labor costs.

—Gene Senn

Denver Slates Conference

The swiftly moving technology of metal forming and the demand for a concentrated program on the subject has prompted plans for Denver Chapter 77's first on-campus conference. The all-day program on the "Modern Art of Metal Forming" will be presented on the campus of Colorado University, at Boulder, on Feb. 20.

Among topics to be covered are powder metallurgy, positional tolerancing, economics of tooling, trends in forging, and precision stretch forming. Robert Ratcliff heads the planning committee.

—Milton Haney

On-Campus Roundup:

Seminar in Mississippi Called 'Star of Hope'

TAKE A GREAT STATE in the heartland of America. Add to it a balmy climate. Provide it with a talented, versatile and hard-working labor supply. Add some new industries and season them with continuing dashes of industrial know-how. Here are the ingredients and the basic formula for a sweeping industrial revolution in the state of Mississippi.

This revolution has been aided and abetted by an outstanding engineering school at Mississippi State University. And, more recently, it was furthered by an on-campus seminar sponsored jointly by the university and the ASTE Mississippi chapter.

The seminar, the first of its kind in the state, was devoted to the topic: "Tool Engineering for Mississippi." The speakers, who came from 10 states, covered such diverse subjects as cutting tools; drilling, milling, grinding and honing; forging and upsetting; cold forming; stamping; cost reduction; explosive forming; and heat treating.

The purpose of the seminar, according to Justus Alexander, chapter chairman, was to give practicing tool engineers an insight into the latest developments in these fields. Dr. Ben Hilbun, MSU president, agreed that the seminar did just that and called it a "star of hope" in the state's industrialization program.

Attendance of more than 100 practicing tool engineers was augmented by more than 250 engineering students who took away with them a real understanding of how the gap between engineering theory and practice is bridged in the nation's leading plants.

Perhaps the best gage of the success of the seminar —aside from the enthusiasm of the participants— is the invitation from the university for ASTE to return to the campus each year with a similar seminar.

Such seminars, according to university officials, are spark plugs for the industrial progress of the state.

Erie Views 'Devices'

Among the "Devices" displayed at an on-campus conference of the same name sponsored by the Erie chapter this October was a bowl feeder, demonstrated by Floyd Smith of Automation Devices Co., Erie, Pa. Watching the experiment are members of Chapter 62 who came to the campus of Alliance Technical Institute to acquaint themselves with new tooling methods. Sessions describing what to expect and how to prepare for their venture into the tool engineering field were well attended by Alliance Institute students. A film, entitled "Reliability," dealing with the importance of high quality component parts in the production of fault-free end products, was shown at another of the conference's sessions.

On-Campus Roundup:

Space-Age Tooling Studied at Tucson

Engineering Dean T. L. Martin of the University of Arizona and ASTE National Director Leslie C. Seager of Salt Lake City were dinner speakers at Tucson chapter's space age tooling seminar.

Coffee break found Fred Kaultenhauser conducting a question-and-answer session with himself about calories. He was on the seminar planning committee.

When the Tucson ASTE chapter and the University of Arizona decided to sponsor an on-campus conference, it was only natural that they should settle on "Space Age Tooling" as the subject. For one's largest impression of the area is of space: people and their plants sprawl freely across the desert; clouds seldom shroud the firmament, and mountains point toward space; jet-stream writing fills the limitless skies. . . . And space—in the form of missiles made at the local plant of Hughes Aircraft Co.—is the livelihood of many of the 145 members of Tucson chapter.

Most of them turned out for the day-and-a-half exploration of space tooling problems which was held on the U of A campus in mid-November. In addition, 88 university students—including most of the 26 ASTE junior members of Tucson chapter—attended the sessions.

Other than their help in consuming 18 dozen doughnuts and 16 gallons of coffee at the seminar's coffee breaks, the students further evidenced their enthusiasm for learning engineering from the engineers themselves by turning out in force for the full day of Saturday talks. One student even requested permission—and got it—to publicly thank the seminar sponsors over the microphone on behalf of himself and his classmates.

Top-flight engineers presented nine papers on electrical discharge machining, milling cutter advances, space-age metrology, numerical controls, machining of high-temperature alloys and of reactor materials, and tooling of semiconductors. Finally, a panel of three educators and three industrialists, moderated by Chief Tool Engineer T. W. Kresler of Hughes Aircraft in Tucson, wound up the seminar with a give-and-take discussion of "What Is Being Done to Educate the Engineer of the Future and What Should Be Done." The panel followed a morning talk on "Courses Designed to Teach Tool Engineering from a Scientific Point of View," in which Dr. A. B. Drought, Marquette University dean of engineering, urged that several engineering centers of a substantial size—rather than one or two giant centers or many small "one-man" centers—be established to effectively fuse teaching and research in manufacturing engineering.

The seminar attendance represented 18 firms. The program chairman was J. D. Beach, who joined Chapter Chairman J. Clark Pierce in welcoming the registrants to Chapter 106's first such endeavor.

—*George H. Moritz*

Members Endorse Directory

"WORTH ITS WEIGHT in gold"—that's what they prophesied and that's what THE TOOL ENGINEER *Suppliers Directory Issue* has turned out to be. Early returns on a survey to determine membership reaction to the Directory are even brighter than the multicolored questionnaire sheets which were sent to 4287 ASTE members.

Among survey respondents 99.9 percent find that the Directory is, within their experience, a reliable source of information. It is a timesaver in locating companies, products and local suppliers, say 94 per cent of those answering. Another 94 per cent of the group specify, recommend or approve the purchase of types or products covered in the Directory. This high percentage testifies to the job application of the products given listing.

An average of 3.1 persons besides the person owning the copy refer to the Directory. The titles of these "borrowers"—company owners, presidents, managers, purchasing agents, and engineers such as manufacturing, plant, process, project, production, tool and many others—indicate the variety of positions in which the Directory is useful.

The questionnaires show that most Directories are kept at work, rather than at home. Owners refer to their copies an average of 3.1 times per week, with the individual number of references per week ranging from 1 to 100.

Using the Directory has facilitated actual company purchases for 63 per cent of the respondents. The types of products purchased in these instances include machine components, materials, test equipment and tools of all kinds.

Although most respondents indicated that the Directory is complete for their needs, some suggested additional listings for certain highly specialized products. Others suggested enlargement, a more durable cover and a more precise breakdown of products as to type and size.

While the 1959 Suppliers Directory continues to fulfill the tool engineer's need for information on manufacturers, their products and local distributors, Headquarters is at work preparing the 1960 issue. It is being groomed to bring to industry the same reliability as in 1959, but a greater amount of information. As many as 20 percent more manufacturers, products and sales outlets will be at the service of 1960 Directory owners.

Members in the News

With 14 years' experience in the tooling field, including supervisory and tool engineering positions with Jack & Heintz, Inc., Wesson Co. and, most recently, Adamas Carbide, JOHN A. ZURA of Cleveland chapter has joined the American Society for Metals as staff engineer assigned to the machinability program that is in preparation for the Air Materiel Command, U. S. Air Force.

Holding a succession of supervisory and managerial positions with Harrington Tool & Die Co., Ltd., Lachine, Quebec, since 1942, GORDON MCNAUGHT has been appointed vice president in charge of sales. McNaught has been a senior member of Montreal chapter since 1949.

JAMES J. ROST, as a result of accepting a position at AiResearch Mfg. Co. of Arizona in Phoenix, was unable to assume his duties as new chairman of Grand Rapids Chapter 38. Rost was selected to receive the Service Award and Pin in recognition and appreciation of his noteworthy service in the chapter. Accordingly, James R. Wagner, immediate past chairman of Grand Rapids requested John Hamay, chairman at Phoenix, to make the presentation in behalf of Grand Rapids.

FRANK RITCHIE, past chairman of Windsor Chapter 55 and currently a member of the National Public Relations Committee, has been promoted to manufacturing manager—Windsor Manufacturing Operations—for the Ford Motor Co. of Canada, Ltd. Prior to this promotion Ritchie was director of manufacturing engineering with office in Toronto.

R. W. HOWELL, Chicago member, has been appointed general manager of the Equipment Steel Products Div. of Union Asbestos and Rubber Co. The division's products include structural steel tubing, steel fabricating, and a variety of steel equipment for the construction industry. Howell will be responsible for the entire manufacturing operations of steel products in UNARCO's plant at Blue Island, Ill. Before his appointment he was works manager of Highway Trailer Co., Inc.; previously was assistant to the vice president and general manager of Houdaille-Hershey Corp. and later held the same position with Rheem Mfg. Co.

Chips and Chatter

QUOTE OF THE MONTH: "I am convinced that we are now on the horizon of an entirely new era of measurement accuracy. . . We have learned through measuring gage blocks, that if you touch them with a measuring probe, the probe will penetrate into the block. We now know that steel behaves like rubber. We must therefore develop measuring tools which can measure to space-age accuracies without actually touching the work being measured."—Glen H. Stimson, chief engineer of Gage Div., Greenfield Tap & Die Corp., speaking at the "Space Age Tooling" seminar sponsored by TUCSON chapter on the University of Arizona campus.

Language is no hurdle in current efforts to establish an ASTE chapter in Mexico, since practically every engineer there speaks both English and Spanish, reports HOUSTON chapter's First Vice Chairman Harry M. Betts, who recently returned from a four-day visit in the capital. Betts found 42 members-at-large in the Mexico City area, meeting regularly every first Tuesday of the month on a year-round basis. Spark plugs of the drive to get a Mexico City charter in time to become the baby chapter of the 1960 convention are John Bailleres, Julio N. Garcia and Federico Delgado R. "The city is so industrially diversified that it can easily support more than one chapter right now," Betts said.

Some approximate membership totals of other technical societies show that ASTE with its 40,000 is well up toward the top of the list: American Society of Mechanical Engineers, 44,600; American Society for Metals, 30,000; American Institute of Electrical Engineers, 50,000; Society of Automotive Engineers, 23,500; American Society for Testing Materials, 9000; American Institute of Mining, Metallurgical and Petroleum Engineers, 33,000; American Welding Society, 12,500; American Institute of Chemical Engineers, 17,500; American Society of Civil Engineers, 41,000.

A new technique—gun grilling—was used in a question and answer session at LONG BEACH chapter following a technical meeting on "Tooling for Toys." At right, Speaker Fred Hayner, shop superintendent of Mattel, Inc., obligingly replies to rapid-fire queries from (left to right) Owen D. McDougal, Chapter 84 third vice chairman; Stan Langley, a Mattel colleague; and Larry Pomerantz, past chairman.The grilling guns are Mattel products, produced to tolerances of plus or minus 0.005 by the toy firm's 9000 employees. As it is unusual for any one toy to sell two years in succession, tools and dies are used for one season only. Hayner said the firm plans a million-dollar research and development program for 1960.

Speaking of arms and men, the Society's well-traveled symbol of mass production—an original Eli Whitney musket—was crated up recently at Headquarters and shipped to New York for its debut on the "American Heritage" show over NBC-TV. The rifle also appeared on Dave Garroway's "Today" show. Shown here "rigging" the venerable weapon for its television appearance—and incidentally dramatizing Whitney's principle of interchangeability of parts—are Headquarters workers Sue Sutherland and Kay Lou Brown and ASTE Executive Secretary Harry E. Conrad.

Willing fall guy of a televised race between a horse and buggy and a modern auto was Pittsburgh chapter member Al Bircher. Here he is shown accepting his assignment—a steel stamping which was part of a lighting circuit needed to illuminate a bicentennial plaque honoring Pittsburgh—from Chapter Chairman Ray Zale. Bircher knew before the race began that it was all "fixed": that his buggy would lose a wheel, that a horseless carriage would rescue his stamping and deliver it just in time for the televised unveiling by ASTE President Ewing, and that a modern auto—carrying a titanium stamping and driven by another ASTE member named Norm Cleary—would easily win the race. But Bircher was willing to lose just to prove that you can't depend on horse-and-buggy methods nowadays.

Pittsburgh Spectacular

FOUR TELEVISION SCREENS in a darkened room simultaneously flashed the story of "The Land of Engineering." When the lights went on after the hour-long spectacular, the audience of more than a hundred tool engineers applauded and felt justly proud of their profession and their Society. . . .

Perhaps some of the applause should have been for the applauders themselves. For many in the crowd which gathered at Pittsburgh's Penn-Sheraton Hotel to watch *their* show—their contribution to a city's bicentennial celebration—had themselves played major roles in their city's progress. Many would be better able to contribute to progress in the future because of activities such as this meeting.

The meeting was the windup session of Pittsburgh ASTE's annual fall seminar, the outstanding feature of an extensive educational program which is sponsored by Chapter 8. This year the course, conducted at Carnegie Tech, was on stamping and presswork; previous courses have covered carbides, tool steels, grinding, and small cutting tools. More than half of the 300 enrollees completed the 1959 course with a perfect attendance record. Three of them—Paul C. Auer, D. G. McCray, and Burton E. Raymond—made a 260-mile round trip from Corry, Pa., each seminar night.

The man most closely identified with Pittsburgh chapter's successful seminar on stamping and presswork is Robert S. Aikenhead, untiring education chairman. Here he presides at the climactic session held Nov. 6, featuring a panel roundup of the seminar speakers.

"The Land of Engineering" program, which represented months of work by Past Chairman Elwood Weissert and producer Sam Francis of educational TV station WQED, pointed up the essential function of the 600 ASTE members in the Pittsburgh area—to build for the future by improving the conditions that existed in the past. The program was taped for eventual distribution among other ASTE chapters.

The attention-getter in the professionally packaged, skillfully unwrapped show was a handicap race between a horse and buggy and a modern auto, deliberately perpetrated to reflect to the credit of engineering, and was entertaining testimony to the skill of the arch-planner and script writer, Weissert. But the real meat of the program was the "live" part—a down-to-earth treatment of punches and dies, acted out by a believable and unsophisticated cast of 16 ASTE characters. It showed the importance of technology in Pittsburgh's way of life and the importance of tool engineers in developing that technology.

Besides the TV spectacular, the climactic session of the seminar also featured a talk by National President Wayne Ewing, who had come to assist the chapter in telling its story to the two million people in the metropolitan area. The ASTE "actors" came over to the hotel from the studios after the program and joined in a windup panel discussion which brought together most of the 14 authorities who had conducted the preceding sessions. —*Ralph Keenan*

chapter news and views

New York Chapter Helps Stage Career Conference

GREATER NEW YORK—A recent proclamation by Mayor Robert F. Wagner of New York announced the establishment of Science and Engineering Career Conference Day in that city. The announcement was made in connection with the seventh annual such conference sponsored on Nov. 21 by the Technical Societies Council of New York in cooperation with the New York City public and parochial schools.

One of the major promoters of the conference has been the Greater New York chapter which represents ASTE in the lineup of sponsors. The group has been more than partially active in all the TSCNY activities. Proof of this is revealed by a review of the council's past and present officers. Julius Schoen of Arista Design & Process Corp. is a past chairman of Chapter 34 and immediate past president of TSCNY. Another man active in both engineering groups is James L. G. Fitzpatrick, present treasurer of TSCNY and also a past chairman of the ASTE chapter. Fitzpatrick is the dean of Staten Island Community College. Many other members of the Greater New York chapter are giving their wholehearted support to the educational activities of the State Technical Societies Council.

The conference itself attracted some 4500 students from the area. Classes at Columbia University, St. John's University and Polytechnic Institute of Brooklyn were staffed by experts in the various fields of engineering. The keen interest and intelligent questioning on the part of the students indicated that many of them know quite definitely the particular branch of engineering they intend to pursue in college. —*Alfred M. Sampter*

Congressman Extols ASTE Role in National Defense

NEW HAVEN—Over 350 members of Chapter 41 toured Botwinik Brothers' plant on Nov. 12. After a brief welcome by President Norman L. Botwinik, the group heard Plant Superintendent Peter De Vit give a resume of the machine tool rebuilding facilities of the company.

At the evening meeting, Congressman Robert N. Giaimo of Connecticut presented a *Tool Engineers Handbook* to Floyd Smith of the Eli Whitney Technical School for being the top design student of the 1959 graduating class.

Giaimo extolled the ASTE for its assistance in our country's missile and satellite program. It is through the combined efforts of such groups as ASTE and through their exchange of ideas, he said, that we will be able to keep ahead of the rest of the world and maintain our standard of living.

LONG ISLAND—Shown promoting the 1960 ASTE seminars at his chapter's monthly executive committee meeting is Chairman Sheldon Meyers. Also on the meeting's agenda were a discussion of plans to send representatives to the ASTE Mid-Atlantic States Regional meeting and a progress report given by the head of a local student group. —*Warren A. Lipman*

NORTHWESTERN PENNSYLVANIA—Ridgeway and St. Marys high schools were this year's recipients of Chapter 128's contributions to the industrial arts departments of a pair of worthy high schools. Ted Smeal (right), Chapter 128's chairman, provided Dean Girts (left), instructor at St. Marys, with a finishing sander and a router. An electric saw and a finishing sander were accepted by William Bishop, representing Ridgeway. —*W. S. Spehalski*

Speaker Discusses Air Gaging Processes Before Ithaca Members

ITHACA—Air Gaging for Production inspection was the topic covered by F. Meyer, Jr., manager of Small Tool and Gage Div. of The Taft-Peirce Mfg. Co. at the Nov. 10 meeting. One hundred two members and guests were on hand.

Simple manual applications up to and including fully automatic and machine-controlled devices were covered. Slides were utilized to illustrate certain functions, such as semiautomatic gages for checking thickness, groove diameters, inside and outside diameters, center distance, concentricity, squareness, ovality, serrations, and taper diameters. Many of these, said Meyer, can be combined into a single gage operation.

The speaker discussed the CompAirmatic electric unit installed on an automatic lathe which, as parts are being machined, approaches tolerance limits. The gaging unit then sends impulses to the lathe controls, calling for the cutting tool to move forward or backward. If the tool does not advance or retract, or is too worn to compensate correctly, the CompAirmatic shuts down the machine.

High-speed inspection of small parts is natural for CompAirmatic, Meyer said. The sorting machine gages small parts, separating them into several different categories: in tolerance, out of tolerance, for two points of thickness, two points of width, and two points of length. Everything is automatic from the time the parts go into the vibratory feeder until received in the bins.

The speaker also discussed the Versacheck electric gage, which is completely portable. Installation consists of an electronic amplifier connected to a pick-up head, mounted either on a heavy-duty comparator stand or height gage stand. Any operator who can read a dial indicator can get accurate readings. Working tolerance is magnified to such a point that human errors are reduced considerably. It completely eliminates the human errors of touch and feel. Because it is portable and operates on standard a-c line, it can be used on lab inspection or beside a machine. It does everything a stand indicator does when mounted on a Vernier height gage or surface gage, and does it with greater accuracy.

Following Meyer's talk a short question and answer period took place. After this, Philip Marsilius, ASTE national vice president, gave a brief outline of the progress being made by the Society from an educational standpoint. He also handed out affiliate membership plaques to six local companies.

—Anna B. Gage

CALUMET—Chapter 112's education and professional development chairman, A. Houghton Buck, spoke to his fellow members at their November meeting. Buck, project engineer at the Blaw-Knox Co., discussed the legal technicalities that often confront engineers, such as contracts, sales, government restrictions, patents, copyrights, and trademarks.

—James T. Reece

John Wisotzkey, employed by the firm which printed the *Tool Engineers Handbook*, was on hand at Chapter 22's monthly meeting to present a copy of the book to one of its project chairmen, Raymond H. Meckley of the York chapter. That chapter's chairman, Richard Streitmiller, looks on at right.

York ASTE Chapter Introduces Handbook To Membership

YORK—At their October meeting Chapter 22 took time out to introduce the second edition of the *Tool Engineers Handbook* and to give credit to two of its contributors who are among the chapter membership. These men are two of the 26 project chairmen who selected and directed the activities of the authors and reviewers for the handbook. They are Raymond H. Meckley, vice president of Flinchbaugh Products, Inc., and David Schrom, ASTE national vice president and works manager at the York Div. of Borg-Warner Corp. Both men are past chairmen of the York chapter.

Also on hand for the introduction was John Wisotzkey, executive vice president of the Maple Press Co., Inc., printer of the handbook. He revealed some of the publication's printing problems and provided Project Chairman Meckley with a complimentary copy of the book.

The York chapter also gave recognition to other industries in the area who have contributed to the *Tool Engineers Handbook* by supplying men to review parts of the book. It was announced that these reviewers would receive copies with compliments of the ASTE chapter.

Following the handbook presentations, guest speaker Robert W. Hohl, chief engineer of Standard Pressed Steel Co., took the floor. His talk was concerned with "Tool and Diemaking." Among the phases covered in his presentation were die and piece costs—from all angles, coil feed applications, progressive dies, product design and its relation to good die design, and the latest methods used by his company in die design and the fabrication field.

—J. George Williams

chapter news index

Industry and Education's Responsibilities In Training Engineers Heard at Kalamazoo

KALAMAZOO—Three educators and two engineers met on the campus of Western Michigan University this October for a precedent-setting ASTE chapter meeting. As participants in a panel discussion, they were determined to find, or at least to suggest, some solutions for bridging the gap that continues to widen between the schools that turn out engineers and the industries that employ them.

Moderator James Rau of the Kalamazoo chapter mediated the differences of opinion arising between the sides consisting of Thomas Bowman, superintendent of Kalamazoo Public Schools; Dean George Kohrman, WMU's School of Applied Arts and Sciences; William Taylor, superintendent of Vicksburg Schools; Russell Buck, president of Buck Tool Co.; and Charles Perkins, chief engineer at Fuller Mfg. Co.

With the increased emphasis on rocket development and space travel, and accelerated demands for greater productivity, what is being done to correct the shortage of engineers? How can schools best help students to prepare for an engineering career in this space age? How can engineers, both as individuals and as members of a group, cooperate with and assist the schools? These three key questions were raised and possible solutions were put forth by the speakers.

Russell Buck, of industry, opened the discussion. There is, in his opinion, a great lack of mathematical training among students of today, especially in trigonometry. This is accompanied by a lack of design knowledge on the part of the graduating engineer. Too much emphasis is placed on drawing training that results only in "a pretty picture." All that is really necessary is a readable drawing with a minimum amount of time spent on it. Buck summarized with the idea that in order to help the student meet the demands of industry, the teacher should be employed by industry for a time so he can understand its mechanics more fully.

Another industrialist followed, Charles Perkins. He felt that the student is not aware of his responsibilities to Society. He, the student, is not being taught to "think," which, with his education, is the most important thing he has to offer. To be really called an engineer, a young man has to have the ability to express himself on the "board." Drawing or designing is the "language of engineering."

Education had a chance to raise its voice when Thomas Bowman took the floor. "Why," he asked, "should we (the public schools) prepare any particular group for a given occupation? Doctors, lawyers, dentists, etc., also have a shortage. Why should there be any favoritism?"

Bowman stated that the caliber of the student in school today is inferior to that of 15 years ago. This is also complicated by the fact that today there is so much more additional knowledge for the student to assimilate. All this must be done in the same allotted time as was available before this additional information was ever known. At the university level there is too much general but essential knowledge to be acquired to spend time on basic shop courses. It is up to industry to do their practical training.

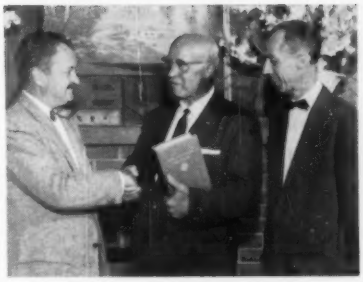
William Taylor was next in the speakers' lineup. The question of quantity and/or quality of engineers is basically one of economics, he said. The whole educational program is related to the economy. The young and talented teachers don't wish to be hired at the wage scales the schools are forced to offer and, as a result, inferior teachers take their places.

As for the student, Taylor said, he is forced to make a choice of a vocation at the age of 15. He is very much impressed (along with his parents) that the high school graduate employed in skilled or semiskilled trades has more monetary remuneration than the young engineer and not too much less than the older, experienced engineer.

The final member of the panel was George Kohrman. He began by saying that the dignity of work should be emphasized. Too many of today's college level students feel that the more education they can acquire, the less work they will have to do later when they take on a job.

In summerizing, the panel members joined forces to come up with several general suggestions, which, if accepted by industry and education alike, could help to alleviate the conflicts existing between them. The first concerned the idea of training engineers in basic techniques. The answer may be in increasing the school tax and extending the length of time for high school and college courses as we know them. The present training for engineers is becoming outdated. Another answer may be the type of setup used by many engineering schools — a cooperative plan. The final suggestion was agreed by the panel members to be the most important. There should be closer ties between the schools and industry. This panel discussion was a good start.

—Don Massey



ST. PETERSBURG—Past national president, Frank W. Curtis, holds an inscribed copy of the new *Tool Engineers Handbook* given him by the members of Chapter 159. G. E. Losey (left) of that chapter made the presentation to Curtis, who is now a member of the St. Petersburg ASTE group and who authored sections of both the new and the old handbooks. At right is W. A. Simcox, chapter chairman. *—James H. Veith*

Chapter 100 Hears Education Leaders

NORTHERN MASSACHUSETTS—Despite an increase of 5.9 percent in over-all college enrollment, a decline of 11 percent over the previous year's enrollment in engineering was revealed through a survey of colleges. So said Prof. Arthur F. Gould, head of the Department of Industrial Engineering, Lehigh University, and chairman of the National ASTE Education Committee, at Chapter 100's Education Night Nov. 17.

The chapter's Science Teacher of the Year award was presented to Richard Lyons of Narragansett Regional High School, Templeton, Mass. John McBride of Union Twist Drill Co. won a *Tool Engineers Handbook* for being chosen outstanding apprentice of the year.

In speaking on "What Industry Expects of the High Schools in Preparing Students for Industry," Leroy L. Dawson, principal of Barre High School, Barre, Mass., urged expansion of the school guidance programs and a diversified but purposeful curriculum.

Past Chairman George Stanley announced plans for possible chapter sponsorship of Junior Engineering Technical Society (JETS) clubs in area high schools. *—Richard I. Edwards*

Rochester Member Dies

ROCHESTER, N. Y. — Erwin A. ("Don") Dony, member of Chapter 16 and a machine tool broker here for nearly 35 years, died Nov. 1 at age 67. He operated the D. E. Dony Machinery Co. in Irondequoit. In World War II, he was cited by the Rochester Ordnance District for his service on the district's machine tool panel.

Washington Schedules Two Automation Talks, Professionalism Panel

WASHINGTON—Chapter 48, which last year changed its name from Potomac to Washington, will come to grips with the need for and the problems of automation at two regular meetings.

Automation's effect on the U.S. economy will be discussed at the Jan. 5 meeting by Chester S. Johns, sales manager, Buhr Machine Tool Co. On Feb. 2, Ted Silvey of the AFL-CIO national headquarters in Washington, will talk about the problems that follow progressive replacement of human labor by machines. Titling his speech "Human Factors in Automation," Silvey will attempt to answer these questions: Will future industry require more or fewer human beings to operate its implements? What level of skills will be required?

Representative of the chapter's range and caliber of programming for the 1959-60 sessions were the December meeting talks on foreign machine tools by Ludlow King, vice president of the National Machine Tool Builders Association, and Burnham Finney, editor of *American Machinist* magazine.

Coming up this spring is a panel discussion of the professional status and professional future of tool engineers.

—Henry C. Howells

TWIN STATES—Chapter 40's first scholarship brought a smile to the face of its winner, Ronald King of Springfield, Vt. Ronald is now using the $200 award as an engineering student at Penn State. With him at the ASTE meeting in Windsor were (left to right) Chairman David Armstrong; Ronald's mother and his father, Wesley King; and Russell Heath, his high school principal. ***—Bernard W. Harriman***

Fond du Lac Honors A Handbook Author

FOND DU LAC—Chairman Walter Wigton presented Jesse Daugherty, vice president of engineering at the Giddings & Lewis Machine Tool Co., with an autographed copy of the new *Tool Engineers Handbook* at the November meeting. The award was made in appreciation of Daugherty's authorship of the handbook's milling section.

E. J. Weller of the General Electric Co., in a talk on "The Hi-E Principle of Machining," attempted to show how high efficiency machining raises quality and decreases costs of many products.

Three Speakers Discuss Tape-Control Machining

SYRACUSE—Eighty-five members heard three speakers elaborate on the subject of "Tape-Control Machining" at the October meeting. The speakers brought up many facts and figures promoting this type of machining, such as cutting cycle time 30 to 70 percent, elimination of fixtures, greater machine utilization, and decrease in scrap because of duplication of parts.

The eastern district sales manager of Giddings & Lewis Machine Tool Co., Louis L. Peeke, was first on the speakers' agenda. Before joining that firm 15 years ago, Peeke held both sales and managerial positions in various basic industries. He was followed by Clyde G. Hellwig, eastern district sales engineer for the same company. He is a specialist in the application of vertical turret lathes, vertical boring mills, planer type milling machines, and aircraft skin milling machines. A recently acquired member of the Giddings & Lewis field sales force was Robert L. Brandenberg. All three men have had extensive experience in the tape-controlled production field.—*John C. Parry*

Rochester Reminisces, Honors Past Chairmen at 179th Meeting

ROCHESTER—Chapter 16 took stock of itself and took time out to honor some distinguished members—its past chairmen—at the 179th meeting held since it was chartered almost 22 years ago. Its present chairman, Ervin Hodson, Jr., and its first vice chairman, VanBuren N. Hansford, noted that Rochester chapter with a membership of 448 is now 17th largest of 161 groups in the ASTE.

In paying special tribute to "the gentlemen who have given so much of their time that we might enjoy a progressive and instructive activity," Hansford traced the history of Chapter 16 from the first organizational meeting held in late 1937 at the Sagamore Hotel. From that gathering of 65 stemmed the chartering in February 1938, with John Barteck of Consolidated Machine Tool as the first chairman. Barteck has since returned to Detroit and is working at Pioneer Engineering & Manufacturing Co. The charter vice chairman and subsequent second chairman of the chapter was Charles Codd, then a master mechanic at the Ritter Dental Co.—and now, at age 86, still an active member of Chapter 16. Along with his son, George F. Codd, also a chapter member, Charles Codd was present at the past chairmen's night held Nov. 2.

Also present to refute the report that all Rochester past chairmen retire to Florida was Past Chairman (1949) William Gordon, retired chief tool engineer of the Camera Works. Gordon still lives in Rochester and keeps busy at his avocation of watch repairing—and, as Hansford put it, "lends a distinguished air to Chapter 16 meetings."

Speaker of the evening was Ernest White, a hydraulic engineer who talked on the pressure-controlled valves made by the Rivett Co., Boston. Among guests was National Director Joseph L. Petz of Pleasant Valley, N. Y. *—Otto Hosford*

LANSING—Frank Flory (left), instructor of mechanical technology at Lansing Community College, and Ralph Vanderslice (right), associate professor of mechanical engineering at Michigan State University, discuss the November program with guest speaker Nevin Bean, technical assistant to the general manager of Ford's Automatic Transmission Div.

SANTA MONICA BAY—Robert Remington, sales manager at Hufford Corp., outlined latest methods in spin forging and new development in power shear forming before 75 members at the October meeting. —*Charles V. Livezey*

Honing and Metallurgy Topics at Hamilton

HAMILTON DISTRICT—The founder of a company which was the first powdered metal plant in Canada, H. F. Johnson of Sheepbridge Engineering Co., addressed the members of Chapter 42 at their November meeting. As was to be reasoned with his broad experience, Johnson gave an extremely informative talk on powdered metallurgy.

At the Hamilton District chapter's October meeting Percy Cook, manager of Micromatic Hone Ltd. of Canada, outlined the advantages to be gained by stock removal and finishes obtainable by honing. Cook is a member of the Hamilton chapter of ASTE.

—*George Bryant*

Keystone Meetings Spotlight Student Achievements

KEYSTONE—At the October gathering of Chapter 101 members, a special certificate of commendation was presented to John R. Krzyzewski, a student at the Penn State University Wilkes-Barre Center. Krzyzewski was the winner of a $400 ASTE International Education Award. One of the boy's instructors, John Hychko, was on hand for the ceremony. At this same meeting, William McAvay, general manager for the Eastern Div. of the Taeburg Tool Mfg. Co., discussed numerical controls.

O. J. Seeds, manager of the alloy department of Cerro de Pasco Sales Corp., and a member of the Greater New York ASTE chapter, spoke at the November meeting. His topic, Cerrotechnics, dealt with, among other things, the low melting temperatures of the various alloys used in compounding low melting metals. The term eutectic, easy melting, was discussed. When two dissimilar metals are alloyed in the right proportions, the melting temperature is lower than either of the parent metals. When three or four metals are mixed in the correct proportions, the melting temperature is lowered even further. A step-by-step process of mold making from low melting alloys was also illustrated by Seeds.

The Keystone chapter played host to 30 students from the Wyoming Valley Technical Institute of Kingston, Pa. Accompanied by instructors, Charles C. Nalbach and Arthur M. Daves, the technical students exhibited such interest in the technical speaker's talk and exposition that their questions kept him at the microphone for an extra hour.

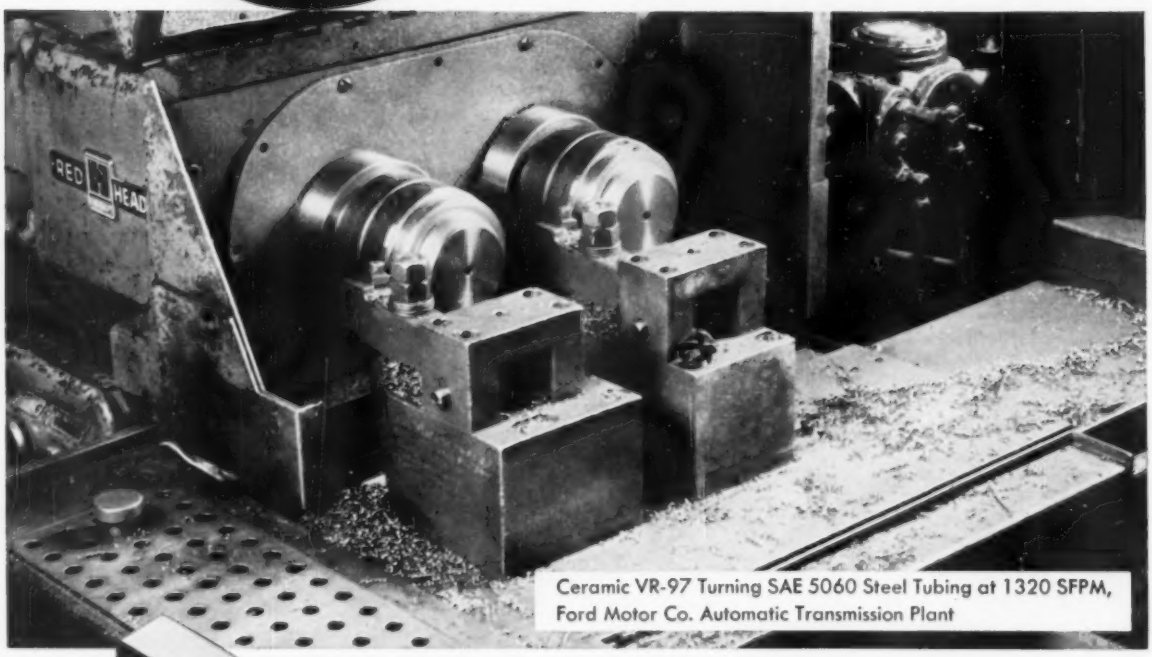
—*William T. Brennan*

LONG BEACH—Upon his receipt of the second edition of the *Tool Engineers Handbook*, K. G. Farrar (left), vice president and general manager of Douglas Aircraft Co., stressed the need for such a publication among the 1800 employees of Douglas' tooling division. Delivering the handbook to Farrar is Raymond E. Gariss, vice chairman of the National Technical Publications Committee.

SPECIAL EVENTS

ASTE Seminar—"Optical Tooling Methods in Manufacturing"	Jan. 12, '60	Sheraton Hotel, Philadelphia, Pa.
ASTE Seminar—"Numerical Control"	Jan. 26, '60	Ambassador Hotel, Los Angeles, Calif.
ASTE Seminar—"What We Know Today about Metal Cutting"	Jan. 28-29, '60	Sheraton-Palace Hotel, San Francisco, Calif.
On-Campus Conference	Feb. 13, '60	University of Colorado, Boulder, Colo.
National Engineers Week	Feb. 21-27, '60	
Second Annual Production Institute	Mar. 21-22, '60	University of Wichita, Wichita, Kan.
ASTE 28th Annual Meeting	Apr. 21-28, '60	Statler-Hilton and Sheraton-Cadillac Hotels Detroit, Mich.
ASTE Tool Show	Apr. 21-28, '60	Detroit Artillery Armory Detroit, Mich.

V-R Ceramic VR-97



Ceramic VR-97 Turning SAE 5060 Steel Tubing at 1320 SFPM, Ford Motor Co. Automatic Transmission Plant

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Ceramic VR-97 is a proven performer in many machining operations at the Ford Motor Company's Automatic Transmission Plant, Livonia, Michigan. Here, and in hundreds of other progressive plants across the nation, VR-97 has been proving its value on continuous production runs. People who considered ceramic tooling as merely "experimental" a short time ago now rely on ceramic VR-97 as an important part of their production picture.

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Progress in Production

NUMERICAL CONTROL INCREASES LATHE PRODUCTIVITY

Positioning controls for turning, facing and boring have been applied by The Monarch Machine Tool Co. to its Series EE, Model 1000 lathe. Numerical control is provided by a modified General Electric Mark II unit. All conventional controls are retained to make the lathe adaptable to normal manual operations.

Data input is from standard 8 channel, 1-in. wide punched paper tape prepared on a Flexowriter. A programmer sets up information which is punched on the tape in block form. Each block directs carriage and cross slide movements from the zero point. Feed rates, spindle speeds and other auxiliary functions are also controlled by the tape.

When tape is read on the tape reader in the control console, information is interpreted in the director cabinet and remains in a memory unit until proper carriage and cross slide positions are obtained. Feedback units on the carriage and cross slide signal the director when the commanded position has been reached.

Numerical control system applied to lathe. Conventional controls are retained for manual operation.

Speeds are infinitely variable between 20 and 2000 rpm. Tape commands can select any of these ranges and any one of five speeds for a given cycle through five manually set potentiometers controlling the main drive motor.

Electronically powered feed motors drive the carriage and cross slide through gear boxes. Each gear box has a low and high feed range as well as a traverse range, all of which can be tape selected. Within each of the high or low feed ranges are nine preselectable feed rates ranging from 0.55 to 6.25 ipm in low and 2 to 25 ipm in high. Any of these 18 feeds can be programmed. Longitudinal and cross feed rates can be separately selected.

Prepared tape and data sheets enable the operator to make his setup quickly. The data sheet establishes a starting point for the cut so the tool can be positioned in relation to the zero reference. Longitudinal and cross zero positions can be shifted by appropriate knobs on the console to bring the zero reference position on the tape to the zero position on the workpiece. Spindle motor speed settings for each of the potentiometers are included on the data sheet. Accuracies of ±0.001 in. on both diameter and length are achieved by this control system.

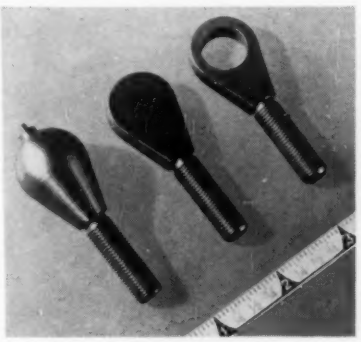
STAINLESS STEEL IMPROVES QUALITY OF MISSILE COMPONENT

Reliability and quality of a critical missile component have been improved by producing it from a free-machining stainless steel instead of a chrome-moly alloy steel. Perfecting Service Co., Charlotte, N. C., working on a subcontract for Douglas Aircraft Co.'s Charlotte Div., has eliminated rejects which formerly averaged 25 percent per lot. The company has increased production of the parts 80 percent by eliminating several operations.

Originally, the component was made from 1 in. round AISI 4130 heat-treated steel having a tensile strength of 125,000 and 145,000 psi. Machinability of the steel was such that the company encountered problems in fabrication, tolerance control and surface finish. The threads, which had to be machined to preplate tolerances, were rougher than desired. Machining was accomplished without difficulty, but it was impossible to hold a required 63 rms finish on two flats. These surfaces subsequently had to be surface ground. The part was then drilled and reamed, the latter operation causing some difficulty because of poor finish.

Although tolerances were held to preplate dimensions, approximately 25 percent of the components that were cadmium plated were rejected. These rejections were caused by thread roughness and plating buildup on feather edges. Vapor blasting and buffing of threads were used to remove the buildup, but these operations increased production costs.

In an effort to increase productivity and lower the rejection rate, the subcontractor tried using AISI type 416 stainless steel supplied by the Carpenter Steel Co. It obtained a quantity of 1 in. round stock heat treated to a tensile strengh of 125,000 to 145,000 psi. It was not necessary to cadmium plate this material because it could be passivated instead at less cost. It also showed superior machining qualities and better finish.



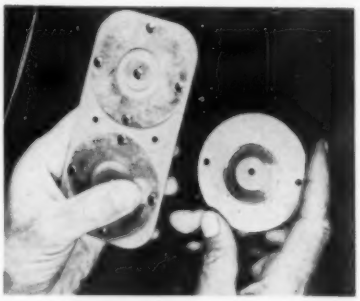
Three stages of production of a missile component made of stainless steel.

Although the initial cost of the stainless steel is higher than that of the chrome-moly steel, the actual cost of the part remains the same as it was when AISI 4130 alloy was used. This is because of savings in plating costs. Since changing to stainless steel, production has increased and rejection rates are negligible.

REDESIGNING TO CUT LABOR COSTS

Elimination of some manufacturing operations is possible by redesigning components to use new materials. This was done by the U-C Lite Mfg. Co., Chicago, in an effort to cut production costs of beacon-lamp terminal plates. Formerly the terminal plates were made

of eight pieces consisting of two zinc disks fastened with five rivets to a piece of laminated plastic. After the plates were redesigned, it was possible to make them of unitized construction using copper-clad Phenolite laminate, a product of National Vulcanized Fibre Co.



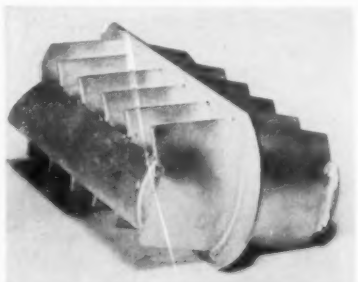
Terminal plates before (left) and after redesigning.

Savings from redesign amounted to five cents on each plate.

Application of this laminate to terminal plates represents a pioneer electrical use of a material which was originally developed for use in printed circuits.

ASSEMBLIES RECLAIMED WITH BRAZING ALLOY

Parts having brazed joints which fail to stand up under severe service conditions can often be reclaimed with a stainless type brazing alloy. An example of this is a turning vane assembly used in a jet engine compressor.



Reclaimed turning vane assembly for jet engine compressor.

Made of 321 stainless steel, this part was originally silver brazed. In service it is exposed to hot gases which have a corrosive effect on the joints. Because only the joints are damaged, the assembly itself can be salvaged.

Reclamation, as performed by Stainless Processing Div. of Wall Colmonoy Corp., involves stripping all silver braze from the assembly and rebrazing using Nicrobraz alloy. Nicrobraz is a nickel-

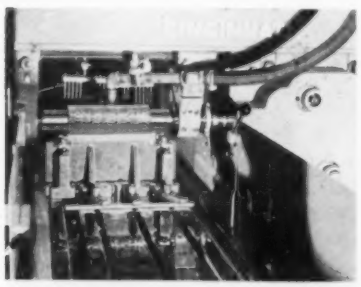
base stainless type brazing alloy designed especially for high-temperature service. When all silver braze has been removed in an acid bath, the components are reassembled and furnace brazed in a dry hydrogen atmosphere.

Reclamation of the assemblies is much less expensive than the cost of scrapping damaged parts. An additional advantage is that rebrazed assemblies resist the corrosive effects of high-temperature gases. More than 10,000 assemblies of this type have been processed with good results.

GANG MILLING FERRITIC MALLEABLE IRON

Gang-milling of 121 slots for comb bars has resulted in quadrupled feed rates, increased tool life and improved product quality at the Federal Systems Div. of IBM.

Made of ferritic malleable iron, the bars act as pivot points for levers in



Gang-saw setup for milling iron comb bars used in data processing machines.

data processing machines. Each bar has 121 slots, each averaging $\frac{5}{8}$ in. deep and 2 in. across. Slots in the comb bars are dimensioned to 0.043 in. + 0.003 − 0.000. Over-all slot relations are held to within ± 0.002 in. and inclusive taper to within 0.002 in.

To gang mill the comb bars, 121 carbide-tipped saws are used. Manufactured by Gay-Lee Co., Clawson, Mich., the saws have tips set in circular seats for greater strength at the root. Ganged saw blades are set radially at random.

Gang-milling feed rates range from 1 to 1½ ipm depending upon the design of the bar and the holding fixture. For optimum production and tool life, the ideal speed range of the thin saws on a horizontal type milling machine is between 280 and 358 rpm, (300-390 fpm) according to the comb bar design.

Tool life on the carbide tipped "thin saws" has been found to be much greater than the life of a similar fly-cutter gang. Use of the saws has resulted in a significant reduction in part rejections caused by dimensional error.

STAINLESS

UNBRAKO socket screws for every assembly need

When you need stainless steel socket screws, get them through an authorized SPS industrial distributor. He offers standard items in austenitic stainless steel as follows:

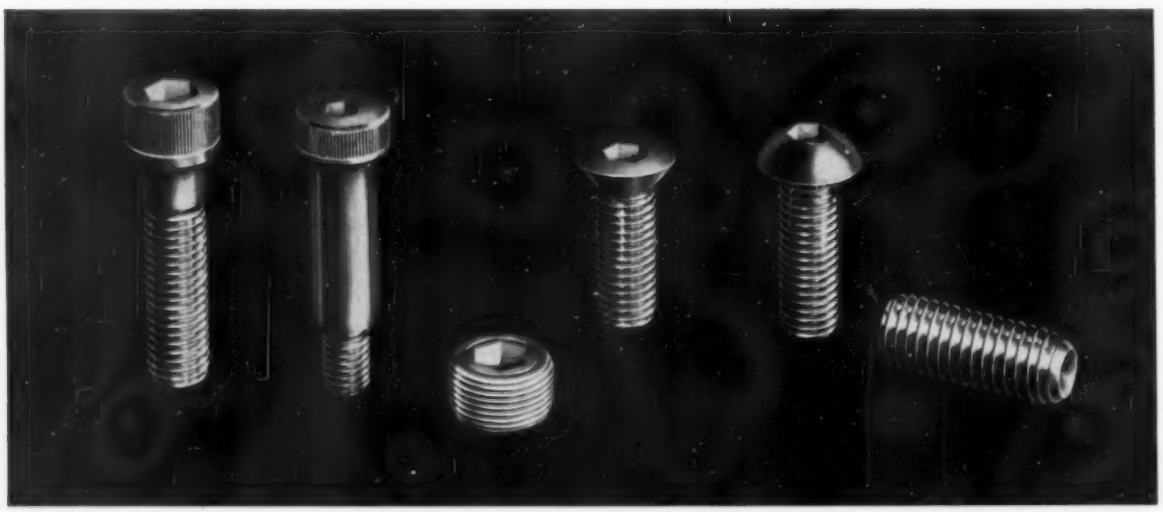
Socket head cap screws.....#0 through ⅝ in.
Socket set screws.....#0 through ½ in.

He can arrange for extremely fast delivery from SPS on other stainless steel threaded fasteners. These include stainless steel socket screws in configurations and size ranges as follows:

Shoulder screws.....¼ through ¾ in.
Flat head cap screws.....#0 through ¾ in.
Button head screws.....#0 through ⅝ in.
Pressure plugs.....1/16 through 1¼ in.

All stainless steel UNBRAKO socket screws are available in two types: regular or self-locking, in a variety of corrosion-resistant alloys. Standard processing includes passivation surface treatment. Silver plating and/or molybdenum disulfide can be added as a lubricant to prevent galling and reduce the thread friction sometimes encountered at elevated temperatures.

Complete listings and prices can be obtained through your authorized SPS distributor. Or write SPS—manufacturer of precision threaded industrial fasteners and allied products in many metals, including titanium. Request new Bulletin 2557.



INDUSTRIAL FASTENER Division SPS

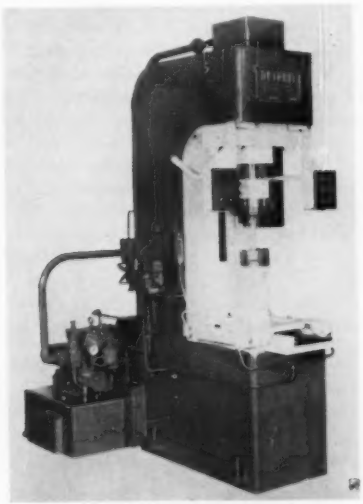
JENKINTOWN 37
PENNSYLVANIA

TOOLS of Today

for more information—use request card, page 173

Riveting Press

Designed for production of 57 pieces per hour at 80 percent efficiency, this 35-ton gooseneck riveting press has a 12-in. stroke. A hydraulic shuttle tray with integral part locator provides ease



of loading. A closed hydraulic circuit in the riveting head adaptor provides equalizing compensation for variation in the size of rivets.

Detroit Broach & Machine Co., Rochester, Mich. **Circle 350**

Adjustable Speed Drive Unit

Eddy current coupling adjustable speed drives from 5 to 100 hp are adaptable to a broad range of industrial applications. The Kinatrol line has simplified design with fewer moving parts for longer service life and sharply reduced maintenance.

The stepless adjustable speed drive package includes the drive unit, control enclosure with control for both coupling and integrally mounted Tri-Clad 55 a-c motor, and operator's station. The unit is pre-wired for quick, easy installation.

Ratings through 20 hp are capable of continuous operation down to 100 rpm at rated torque providing a speed range of approximately 17:1.

Automatic control provides close speed regulation as standard. On a typical friction type load, regulation of 2 percent of full speed can be ob-

tained with standard equipment. All ratings are in hp delivered at output shaft of coupling, rather than at output shaft of a-c motor.

Control enclosure elements are all front wired. Exciter-regulator components are mounted on a plug-in component board for quick replacement.

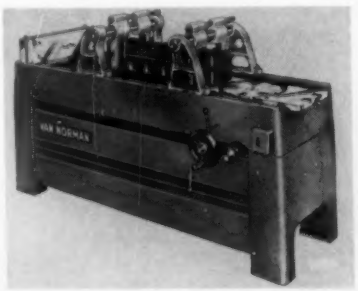
General Electric Co., Erie, Pa. **Circle 351**

Rotary Broach

Resurfacing of cylinder heads, engine blocks and similar work in three steps is done with Model 570 rotary broach. An average cylinder head can be resurfaced to the finish required for gasket seals in less than 10 minutes.

Steps required in the process are setting up of work on the loading table, setting of the micrometer up-feed control for required positive stock removal, and starting of the automatic traverse feed. Machine shutoff is automatic.

A built-in loading table permits fast, top-side setups directly from machined surface of work. Level-line position-



ing assures accuracy. The machine's cutter provides individual, easily replaced carbide inserts which can be sharpened with a special cutter lapping fixture, eliminating the need for factory sharpening service.

Van Norman Machine Co., Springfield, Mass. **Circle 352**

Button Welder

An optional version of the CP C-OManual button welder is designed for high-production rates in plants where manufacturing lines are automated.

Button welding is a versatile, low-cost process for joining steel from 0.035 to 0.250 in. thick. Carbide dioxide is used as a shielding agent. The finished weld may have a reinforcing rivet head or flat appearance as application demands. A consumable electrode adds filler metal to the weld.

The basic equipment package consists of a constant-potential 600-amp power source with slope control, Stellarweld reactor, wire drive that can feed an electrode at an adjusted rate of speed, and a semiautomatic gun.

All power, gas and water connections

are quick-disconnect type, providing simple, rapid maintenance. Prime components of the unit can be quickly removed from the line for repair and spare components put into service immediately. Foolproof disconnect design prevents improper connection.

Major components of the package permit a highly flexible choice in locating the power source and wire drive. The welder's controls are encased in a separate unit for location in an area free from the dangers of damage.

An electronic timer provides precise timing of weld period. Weld time is independent of all variables, providing uniform welds even on the lightest gages. Decade adjustment allows precise setting of weld time measured in cycles.

The Stellarweld reactor, placed in series with the direct current output of the power source, is designed to overcome extremely high short-circuit current surges which create a high amount of weld spatter. It is also used to control penetration when welding sheet metal to prevent burn-through and assist in bridging gaps.

The wire drive contains a variable-speed motor held constant at a set speed by a breaker type governor. Motor speed settings may be made manually or from a remote control station. Speeds of 1200 to 6000 rpm are reduced with a 60/1 gear reduction, giving output shaft speeds of 20 to 100 rpm.

The water-cooled gun assembly is simple to operate, well balanced, light in weight and provides good arc visibility. Contact tubes are available for $\frac{3}{64}$, $\frac{1}{16}$, $\frac{5}{64}$ and $\frac{3}{32}$-inch diam wires.

Welding Products Div., A. O. Smith Corp., Milwaukee, Wis. **Circle 353**

Gaging System

Mating parts can be ground to fit within a few millionths of an inch by a 4-in. grinder with built-in Grand-A-Mate gaging system.

The machine can be used for grinding such critical mating parts as missile control valves, fuel injector plungers

and ultraprecision shaft-like parts. It can also be used to grind one-of-a-kind parts such as master gages and other high-production parts under gage control.

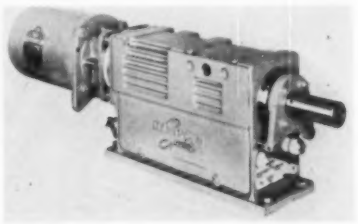
The grinder achieves tolerances within 0.000010 in. for roundness, 0.000020 in. for straightness, 0.000025 in. for size and four microinches for surface finish. The Air Jet caliper built into the grinder does not touch the work diameter, thus eliminating any chance of chatter or taper due to pressure of the gage.

The gaging system consists of OD and ID air gage units and a high-amplification differential meter. Clearance between the mating parts is simply set on a dial; there is no need for separate master gages for each clearance setting.

Cincinnati Milling Machine Co., 4701 Marburg Ave., Cincinnati 9, Ohio. **Circle 354**

Automatic Drilling Head

Air-hydraulic operation provides smooth, positive action and easy adjustability in the Model 17-400 drill



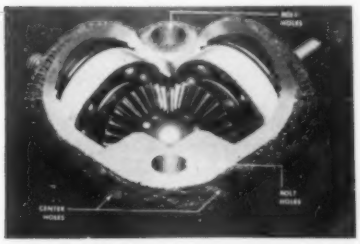
unit, which is used with building block components. The unit has minimum quill deflection, removable valves for routine maintenance without disassembly of the main unit, integral depth stop and mechanical reversing switch, and an integral air valve and built-in filter for air supply protection.

The unit can be supplied with direct, pulley gear or pulley-driven gear drives. Spindle motors from $\frac{1}{3}$ to 5 hp provide torque capacity up to 500 in-lb.

The Hartford Special Machinery Co., Hartford 12, Conn. **Circle 355**

Heavy-Duty Angle Drive

Facilitating use of an angle drive as a machinery component whenever power must be transmitted at a right angle, the case of the drive illustrated is predrilled both for mounting bolts and to provide center holes in dead alignment with the shafts. The unit's heavy-duty bearing structure has ball races ground in the end of hardened gears to provide both thrust and radial stability and is



the key factor permitting continuous use under severe load conditions without overheating.

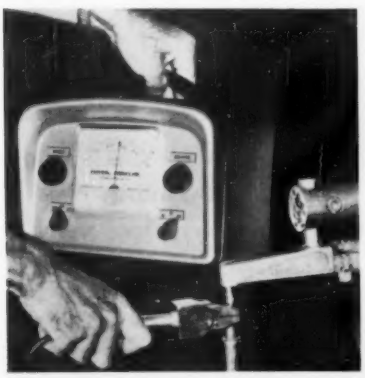
Performance specifications include transmission in a 1:1 ratio of 1⅓ hp at 3000 rpm or ⅓ hp at 750 rpm, and a maximum allowable speed of 6000 rpm with standard lubrication. It can be used with air drills, flexible shafts or with standard ¼-in., 5/16-in. and ⅜-in. electric drills.

Tool dimensions are 2¼ in. for the casting only, and 4¼ in. over-all including chuck. Weight with chuck is 1¾ lb.

Price & Rutzebeck, Box 30, Hayward, Calif. **Circle 356**

Force Gage

Pressure exerted by the electrodes of resistance welders is measured with a high degree of accuracy with an electronic force gage which has a transistorized amplifier and its own power supply in the form of two small, replaceable dry-cell batteries.

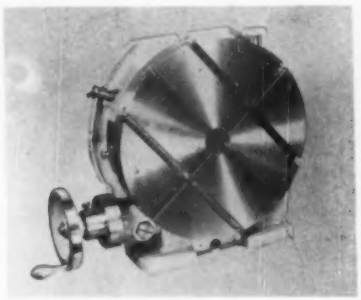


Panel controls are provided for checking the batteries and for calibration, ensuring accurate results each time the gage is used. Batteries, amplifier, controls and meter are all contained in a 7½-lb case with carrying handle. An 8-foot cable connects the amplifier with a transducer unit which is hand-held between the jaws of the welding machine while the welding current is turned off.

Control Devices, Inc., 825 S. Eton, Birmingham, Mich. **Circle 357**

Rotary Tables

For use in both vertical and horizontal positions, four rotary tables are available in 9, 12 and 15-in. sizes. Models U19, U-12, U-15 and U-15-4 have an



accuracy of 60 sec or less through 360 deg of rotation. The worm is easily engaged and disengaged, and all tables have a noninfluencing positive lock and large, one-minute graduated dials.

Dividing attachments with index plates are available for all models.

Troyke Mfg. Co., 11294 Orchard St., Cincinnati 41, Ohio. **Circle 358**

Self-Storing Air Hose

Hose reels and other storage facilities are eliminated when a self-storing hose is used with portable air tools and hoists.

Designed to replace rubber hose for compressed air lines to grinders, wrenches, nut setters and rivet guns, the hose is lightweight, reducing operator fatigue, is resistant to kinking and is able to absorb twist. It is supplied

coiled with reusable fittings and a spring guard to prevent crimping.

Made from a special flexible polyamide formulation, the hose has nylon's inherent imperviousness to oils, dimensional and chemical stability and toughness. The microfinished bore, combined with full-flow, nonflared fittings, assures unobstructed air flow at all times for pressures to 200 psi. Maximum working length is approximately 20 ft while coiled length is under one ft.

Synflex Products Div., Samuel Moore & Co., Mantua, Ohio. **Circle 359**

Electrostatic Chuck

A smaller production model of an electrostatic chucking system allows precision surface chucking of nonmagnetic metals and even nonconductors.

The unit, with 5 x 8-in. workholding surface, has been developed primarily for use in experimental shops, toolrooms, and for small-run production. Comparable in precision performance

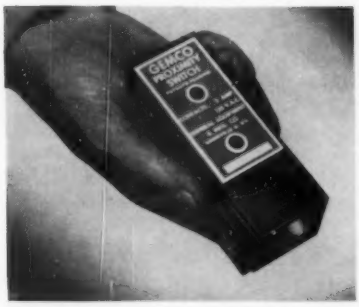
with larger units now in use, the small model is supplied as a complete system with compact power supply, mist dielectric coolant unit, stops, dresser holder, fluids, and recoating kit.

Electrostatic chucking permits precision chucking of nonmagnetic materials such as brass, bronze, aluminum, titanium and stainless steels, as well as nonconductors, typically ceramics or plastics, if these are first "flashed" with even a few millionths of an inch coating of conductive metal.

Electroforce, Inc. Fairfield, Conn. **Circle 360**

Proximity Switch

Containing only one moving part, this proximity switch is self-contained in a 10 cu in. hermetically-sealed brass housing, impervious to coolants, abrasive dust and dirt, and temperatures ranging from minus 50 deg to plus 250 deg. It operates without transistors,



tubes, coils, relays or amplifier. The switch requires no power input and operates completely without physical contact with its actuating means.

General Equipment & Mfg. Co., Inc., Dept. TP, 116 S. Campbell, Louisville 6, Ky. **Circle 361**

Single-Probe Meter

Suitable for use on any magnetic material between the extremes of electrical sheet and cast iron, a self-contained magnetic miniature layer thickness gage may be used on any nonmagnetic coating material including paint, enamel, lacquer, plastic, porcelain enamel or

nonferrous metals.

The meter is available in three measurement ranges: 0 to 0.005 in., 0 to 0.10 in., and 0 to 0.030 in. It is suitable for measurement of curved surfaces and a pointer clamp, which traps the pointer in the deflated position, makes it possible to take readings in areas where the scale cannot be seen.

The O. Hommel Co., Carnegie, Pa. **Circle 362**

Welding Heads

Automatic head units for use with the Heliweld (tungsten-inert gas) welding process are electrically controlled. They can be used for either a-c or d-c, without an accessory control. Argon, helium or argon-helium mixtures can be used as required. Models HMH-D and HMH-E will handle long-run pro-

duction welding applications on all ferrous and nonferrous metals. Model HMH-D is equipped with 3-in. and 12-in. offset bars to which the machine holder can be attached.

Features of the heads are sensitivity of response to changes in arc length; touch or high-frequency starts; 360-degree rotation in any position with a

2-in. adjustment of the machine holder across the weld bead; and vertical travel distance of 14½ in.

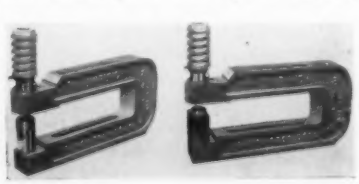
The units can be operated at a maximum 500 amp continuous duty cycle, d-c straight polarity using thoriated tungsten electrodes or 350 amp a-c. Electrode diameters from 0.010 in. through 3/16 in. can be used. Holders have a maximum vertical rate of rise of 24 ipm.

Air Reduction Sales Co., 150 E. 42nd. St., New York 17, N. Y. **Circle 363**

Hole-Punching Unit

Unipunch type AJ units have all-steel cast holders which provide high tensile strength, long wear and greater bearing surface for punch guides. These hole-punching units are available with either pedestal dies or die adapters with button dies.

Pedestal dies are used for punching holes in angles, extrusions, channels and formed parts with lips or flanges.

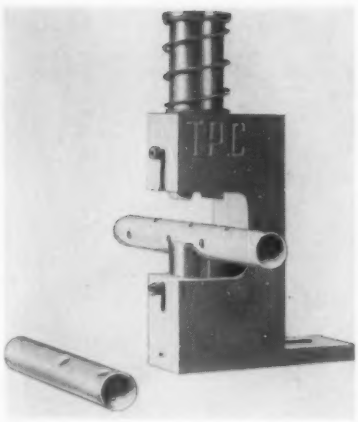


The slug chute can be directed to prevent piling up of slugs in setups for punching a cluster of round and shaped holes with a group of punch units.

Die adapters provide inexpensive die button replacement and interchangeability of standard low-cost die buttons. The punches and dies can be interchanged in the units without disturbing the press setup.

The series has a 8⅜-in. shut height and 3½-in. die height. Unipunch Series AJ units are available in 1¼, 1½ and 2-in. holder widths with 4, 8 and 12-in. throat depths for punching holes in up to ¼-in.-thick mild steel.

Punch Products Corp., 3800 Highland Ave., Niagara Falls, N. Y. **Circle 364**



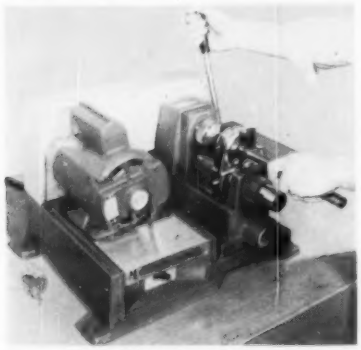
is required. Multiple punching of a tube can be done by arranging a number of units in a press or press brake.

Component parts are machined by the manufacturer to customer specification. Variations of the perforator are available for punching of hexagonal, square and oval shapes, extruded or rolled.

Tool Products Corp., 377 Old Falls Blvd., North Tonawanda, N. Y. **Circle 366**

End Finishing Machine

For simultaneous deburring, facing, and chamfering as well as drilling, reaming or light spinning operations, the Model 600 end finishing machine is a rigid production unit with controlled alignment between the workholding jaws and the rotating toolholder. New features simplify setup, operation and maintenance. The simple design and convenient operation allow even unskilled operators to accurately finish up to 800 ends an hour.



Increased chip clearance under the toolholder is provided. Hand holds in the base make it easy to move the unit for balancing work flow or for variation in jobs. The machine weighs 175 lb and requires a space 20 in. wide and 17 in. deep.

Pines Engineering Co., Inc., 601 Walnut St., Aurora, Ill. **Circle 365**

Hole-Punching Unit

Ability to perforate just one hole or two opposed holes with one stroke of the press is a feature of this self-contained unit. Holes may be of different diameters and configurations and no mandrel

Temperature Measuring Instrument

Temperature of precision parts, gages, instruments and machines, and the surrounding air with respect to a reference temperature, can be measured with this portable electrical instrument. The Teletemp measures the deviation of temperature at five separate points of inspection, independently, at the turn of a dial. Deviation at each temperature detection point is read on an indicating·

meter as plus or minus from one tenth to one fortieth of a degree.

The instrument is used to indicate when parts are "cooled out" and to eliminate or minimize errors caused by temperature variations in making precise measurements. It measures the difference between the temperatures of the dimensional standard used to set up the inspection instrument and the part being inspected.

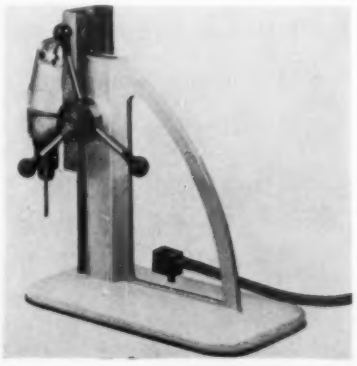
The temperature indicating meter has three temperature amplifications and ranges, operator selective, to permit fine, medium and coarse temperature variations to be measured.

The instrument is supplied with a calibrated chart relating precise temperature deviation to the meter reading of each of the five thermocouples supplied with the unit.

The Sheffield Corp., Dayton 1, Ohio.
Circle 367

Vacuum Drill Press

A powerful vacuum plate base gives a portable vacuum drill true drill press accuracy in areas and with materials previously considered impractical. The vacuum drill can be attached to materials including concrete, wood, plastics and ferrous and nonferrous metals. The



unit will drill large aluminum and stainless steel sheets.

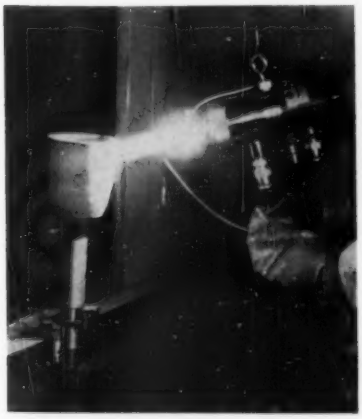
In use, it is positioned over a center punch mark and vacuum applied with a switch valve mounted on the base. By mounting the portable vacuum drill directly over the workpiece, greater drilling accuracy is insured. A rubber gasket around the bottom perimeter and a pressed cork scuff pad protect both the workpiece and the base. The drill may be used in any position—upside down if necessary.

The vacuum drill is available with an aspirator switch valve for converting air pressure into vacuum or a portable 110-v vacuum source.

Tempus Corp., 1211 Goodman Ave., Redondo Beach, Calif. **Circle 368**

Plasma-Arc Spray Gun

Utilizing the plasma-arc principle, the spray gun illustrated develops normal work temperatures of 10,000 to 15,000 deg and will spray any material that will melt without decomposing. It provides a practical means of applying coatings of high melting-point materials



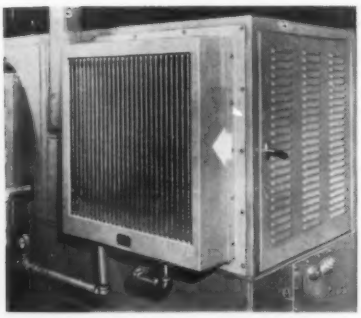
such as zirconium-carbide, boride and oxide; tungsten and tungsten-carbide; and niobium-carbide.

The spray gun operates on inert gases such as nitrogen and hydrogen, eliminating flashback and explosion hazards. Coating densities are easily controlled and approach 98 percent of theoretical.

Metallizing Engineering Co., Inc., Westbury, L. I., N. Y. **Circle 369**

Oil Cooler

With a maximum output of 30,000 Btu/hr, holding a maximum operating oil temperature at 130 deg, at an ambient cooling temperature of 90 deg, a special air-to-oil cooler is made to speci-



fications for a Kearney & Trecker tape-controlled, hydraulically operated, multipurpose machine tool.

Maximum temperature control for most efficient tooling performance is provided by the high-pressure core oil cooler. Turbulators break hot-oil flow for maximum heat transfer with minimum pressure drop. Aluminum fins are bonded to red brass tubes under pressure. Headers are made from one-piece seamless steel. The fan is mounted on the motor shaft and motor support is adjustable. Air entry ring is one piece, heavy sheet metal with rear guard. The electric motor has ½ hp and a 23-in. diam fan. Dimensions of the cooler are 34¾ in. high, 33½ in. wide and 15¾ in. deep.

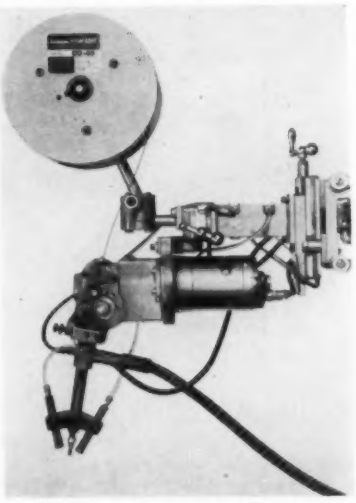
Young Radiator Co., Racine, Wis. **Circle 370**

Automatic CO_2 Welder

Weld wire is fed continuously without lag or slowdown at high-speed rates in this fully automatic CO_2 welding equipment package. An automatic welding head, coupled with a 100 percent duty cycle, 600-amp constant-potential power source, has a two-speed mechanical gearshift. Wire speeds from 55 to 1200 ipm are possible.

The equipment uses small diameter wires designed for welding mild and medium carbon steels. CP C-Omatic welding provides high-quality weld metal, high deposition rates, deep penetration, low-hydrogen weld metal, visible arc and no slag removal. It can be used for single and multiple-pass butt welds, flat and horizontal welds, positioned and horizontal fillet welds, and circumferential butt and fillet welds.

An electronic control panel provides instantaneous, constant contral of wire speed with resultant constant amperage. Start, stop, crater-fill stop, inch-up, inch-down, and gas and water purge buttons are located on the door of the panel. The crater fill circuit contains a vernier adjustment as well as a dial-controlled slope of current decay that can be changed to suit particular applications.



Completing the equipment package are: a heavy-duty, water-cooled nozzle with external shielding for heavy production use; three-position mount; and an attached reel mount for holding spooled or coiled wire.

Welding Products Div., A. O. Smith Corp., Milwaukee, Wis. **Circle 371**

Tapping Attachment

An adjustable torque, high-production tapping attachment, the 500 A, meets requirements for handling fluteless and standard taps. Recommended maximum speed is 2000 rpm, at which

speed the unit reverses at 3000 rpm.

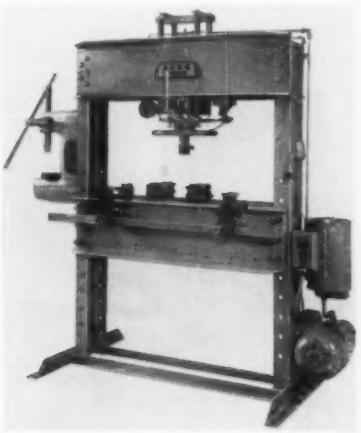
Easily adjusted torque control graduations are based on the breakage factor of taps, minimizing breakage even in blind-hole tapping.

Capacity of the attachment is No. 4 to $\frac{5}{16}$-18 in. tool steel taps. Weight is 2 lb, 12 oz. Length is $5\frac{1}{2}$ in. and diam is $2\frac{23}{32}$ in.

Tapmatic Corp., 845 W. 16th St., Costa Mesa, Calif. **Circle 372**

Electric-Hydraulic Presses

Motorized presses for jobs requiring pressures of 60 and 80 tons respectively are provided with completely enclosed hydraulic systems which prevent fluid contamination. They are equipped with easily removed fine mesh screens to filter the oil supply. Fittings and connections are designed to contain the high pressures developed during work cycles.



Worktables can be moved through a wide range of travel by a self-locking worm-gear reduction winch.

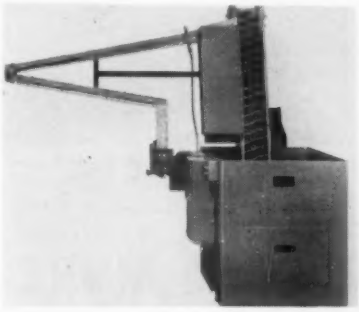
The worm head on the 60-ton press can be moved by finger pressure to any desired work position.

Both units are available in two models for different operating characteristics. Model MHP-60-E22, 60-ton capacity, has a 2-hp motor, ram speed of 10 ipm at no load and 6 ipm at capacity. Model MHP-60-E55, also of 60-ton capacity, has a 2-hp motor, ram speed of 25 ipm at no load and 17 ipm at capacity. Model HP-80-E22, 80-ton capacity, has a 2-hp motor, ram speed of 10 ipm at no load and 5 ipm at full load. Model HP-80-E55, equipped with a 5-hp motor, has a ram speed of 25 ipm at no load and 15 ipm at full load.

American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport 2, Conn. **Circle 373**

Hopper Feed Orienter

Transfer mechanism which changes the position of rolling parts has been added to the Model 4000 hopper feed. The equipment is used when parts must be changed from a rolling to an end-to-end position. Rate of feed ranges from 0 to 400 parts per min. Hopper capacities are $7\frac{1}{2}$ or 12 cu ft and elevating heights can be varied.



Production Feeder Corp., 3130 Johnnycake Ridge Rd., Mentor, Ohio. **Circle 374**

Nylon Stop Nuts

One-piece, washer-faced, resilient hexagon stop nuts are composed entirely of DuPont Zytel 101 nylon resin and molded to ASF width dimensions, allowing for use of standard installation and removal tools.

Brilok stop nuts are recommended by the manufacturer for applications where light weight, form stability at high temperatures, abrasion resistance, corrosion resistance and strength in thin sections are specified.

Pheoll Mfg. Co., 5700 W. Roosevelt Rd., Chicago 50, Ill. **Circle 375**

Rolling, Flanging Coiler

Illustrated with a flanging attachment, this Curvit C-155 coiler performs flanging operations formerly done on a 500-ton press. The special attachment rolls 5/16 to 5/8-in. flanges in 30-in. OD stainless steel rings at a rate of 90 per hour.

The coiler can be set up to simultaneously roll and flange in one operation. The flanging attachment operates under pressure of 6000 psi at 80 psi air pressure. The drive die roller is reduction gear driven by a 5-hp electric brake motor.

The machines will coil pipe, tube, wire, strap flat stock and solid bar stock up to 2½-in. OD.

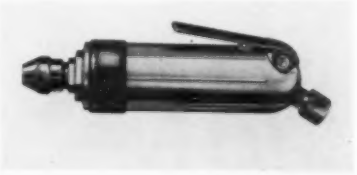
Curvit Div., Maclodyne Corp., 19 Grovesnor Ave., East Providence, R. I.

Circle 376

Pneumatic Die Grinder

Recommended for polishing, wire brushing, and metal removal on dies, stampings, gear teeth, plastics, tubes, castings and weldments, Model 1600 has a metering trigger that delivers 0 to 25,000 controllable rpm, allowing an operator to throttle down for feather edging.

The grinder takes standard rotary files, standard or carbide wheels, wire brushes, mounted points and sanding



drums. Wheel capacity is 1¼ in. vitrified and 1½ in. organic. The unit is furnished with a ¼-in. collet machined on the shaft for minimum runout and a ⅛-in. collet that slips into a ¼-in. collet body.

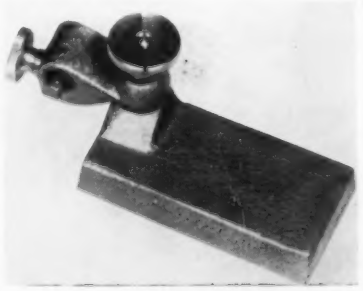
Superior Pneumatic & Mfg., Inc., 13800 Enterprise Ave., Cleveland 35, Ohio.

Circle 377

Dial Indicator Holder

Rapid mounting of dial indicators on any flat surfaces of machines or angle plates can be done with a self-attaching magnetic holder which provides versatility in the application of dial holders to surface plate inspection or in controlling fine machine adjustments or feed movements.

A swiveling clamp permits angular adjustments of the indicator to the

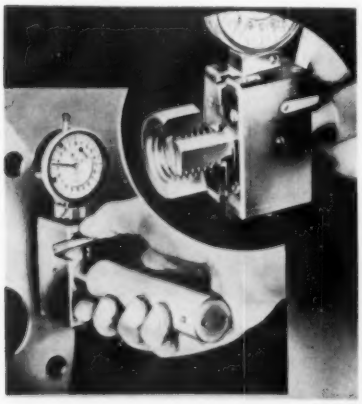


working position, and will accommodate varied dial indicator shank sizes by means of interchangeable sleeves.

Mueller Gage Co., Div. of Mueller Laboratory, 1052 N. Allen Ave., Pasadena, Calif. **Circle 378**

Plug Gage

Internal threads can be checked in one operation with this thread plug gage. The instrument has three measuring jaws representing master thread gages, one of which is retractable between the other two. With the indicator set at zero with a ring gage, the instrument is inserted and the measurement of the inspected female thread and its tolerance position are immediately readable on the dial.



Four sizes cover a range from 0.080 to 4.800 in. The instrument can be used with cylindrical-face measuring blades, converting it into an adjustable plug gage for checking smooth bars or minor diameter of nuts.

Mahr Gage Co., Inc., 274 Lafayette St., New York 12, N. Y. **Circle 379**

Tangential Wheel Dresser

Cutters and abrasive wheels are interchangeable in this grinding wheel dresser. Six in. long with a ¾-in. diam shank, it is made of high-tensile strength cast-aluminum alloy.

The tangential angle of the cutters and wheels eliminates the need for a breaking device and gives sharp, cool grinding while eliminating burn checks and flying dead grain.

Model No. 10 will fit standard Peterson cylinder heads and Lempco grinders.

L. Newman, 1001 24th St., Oakland 7, Calif. **Circle 380**

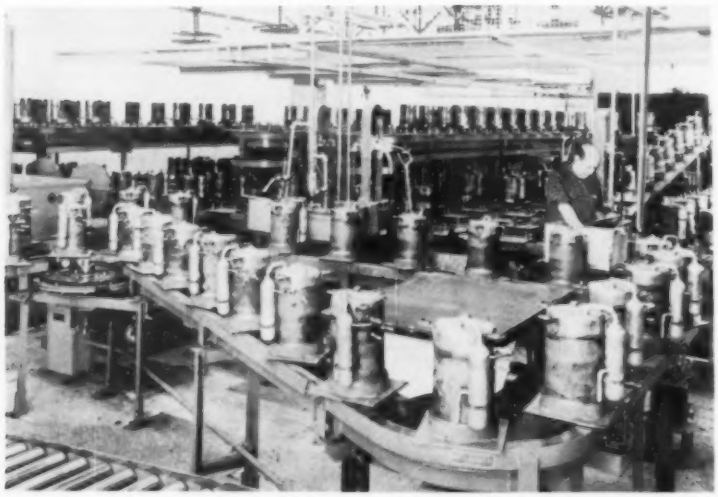
Table-Cable Conveyor

Built to handle a variety of products through assembly at worktable heights, this conveyor has four-wheel carriers running on angle tracks, carrying light or medium weight loads on pallets or fixtures. Trolleys are bolted to Bush-Lock cable with standard blocks.

A selection of components includes a corner turn, with cable sheave and rider plate, bearing-mounted, and providing directional change of from 90 to 180 deg; a take-up turn, with movable sheave assembly and slotted bridge angle track; and a compact drive turn with slip clutch and variable speed.

E. W. Buschman Co., Clifton & Spring Grove Ave., Cincinnati 32, Ohio.

Circle 381



Gaging Modules

Standard electronic modules which can be easily assembled into semi or completely automatic high-speed inspection systems for simple or complex dimensional measurements have 100 percent repeatability, high reliability, flexibility, immediate response and accuracies in millionths. Applications include automatic hardness testing, self-compensating grinder controls, valve and spring testing and parts inspection.

The system's five basic building-block units are (1) the AGMC master gage control; (2) the ATM Thyraton switch unit; (3) the APS power supply; (4) the DC-7 difference computer; and (5) the SC-7 sum computer. The units can be supplied individually or as an integrated system.

A selection of nine gage heads provides scale readings from 0.005 to 0.020 in. with the GMC unit.

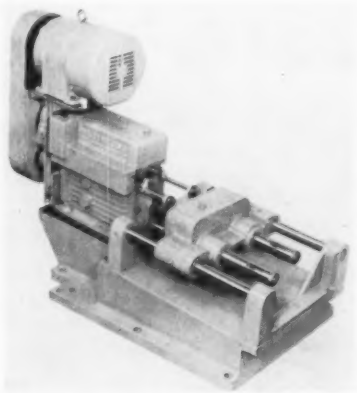
Radio Corporation of America, Industrial and Automation Div., 12605 Arnold Ave., Detroit 39, Mich.

Circle 382

Peck-Drill Unit

Multiple-spindle peck-drilling units operate with a "step and repeat" action in which the drills, at the end of each step, automatically pull out chips and then, at the start of the next step, stop just short of the previous depth.

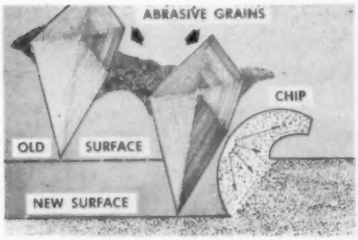
The units can be added to any machine or can be used to replace old style units without tooling changes.



Drillunit, Inc., 3267 Wright St., Detroit 7, Mich. **Circle 383**

Wheel Dresser

Treatment for grinding wheels retards loading and functions as a dry coolant. Pore surfaces of wheels are impregnated by dipping in Dri-Kool, which acts as a parting medium. The



lubricant prevents chip metal from gripping the abrasive and bond surfaces.

The treatment provides burn-free dry grinding of high-speed steels, with less frequent dressing, longer wheel life and faster grinding.

King Graphite Products, Inc., 21950 Telegraph Rd., Trenton, Mich.

Circle 384

Oil-Sand Binder

An oil-sand binder called Britecast "0," based on the mineral attapulgite, improves quality of nonferrous castings. It will produce precision castings with regular green sand equipment. The product is used with mineral oil and fine silica sand. One hundred batches mull in three to five minutes and inflammable or toxic solvents are not required during milling.

Minerals & Chemicals Corp. of America, Essex Turnpike, Menlo Park, N. J.

Circle 385

Tapping Attachment

A self-powered attachment for punch and multislide presses can tap 6000 holes per hour, depending on the depth and size of the hole. It can be mounted for either vertical or horizontal operation.

Tap range is up to 5/16-in. diam. Average speed is 1750 rpm and withdrawal is 3500 rpm. Reversal at end of stroke and resetting to forward rotation is instantaneous.

Smith Mfg. Co., Cleveland 13, Ohio.

Circle 386

Stock Straighteners

Capable of 20 to 80-fpm stockfeed, a line of straighteners handles coiled stock 4 to 10 in. in width and 0.020 to 1/8 in. thickness. Models are available with five or seven straightening rolls and with motor ratings of 1/2 to 1 hp.

Each model has variable speed control and is equipped with two motor-driven pinch rolls which power all lower rolls. Upper straightening rolls are individually adjustable.

The machines can also be used for straightening blanked parts and for deburring shear-slit stock.

H. E. Dickerman Mfg. Co., 321 Albany St., Springfield, Mass. **Circle 387**

Plastic-Ceramic Material

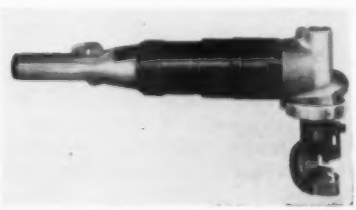
Combining the heat and wear resistance of ceramic with the mechanical durability of plastic, Duramic Grade S-3 is a molded aluminum-oxide ceramic which, after casting, is impregnated with a high-temperature plastic resin. It is available as finished tooling or as a raw material from which tooling can be fabricated.

Illustrated is a buffing fixture able to withstand the abrasion of compounds which wear away conventional steel tooling. Because of its high heat resistance (over 600 deg) the material is able to maintain size longer than straight epoxy tooling.

Duramic Products, Inc., 426 Commercial Ave., Palisades Park, N. J. **Circle 388**

Steel Nibbler

Straight or contour cutting of sheets too large to be handled by stationary cutting tools can be done with a heavy-duty portable nibbler. The tool cuts through No. 8 gage mild steel or No. 10 gage stainless at a rate of six fpm,



leaving both edges of the cut free from distortion.

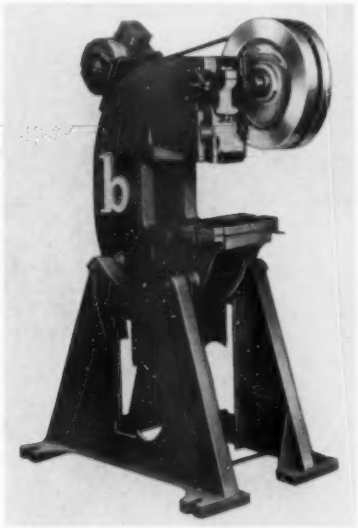
The nibbler uses a vertical punching motion at high speed to take sharp, rectangular bites ¼ in. wide out of the metal. Minimum cutting radius is five in. The tool is 15 in. long, weighs 12½ lb and is air powered.

An electric model is also available.

Buckeye Tools Corp., 5003 Springboro Pike, Dayton 1, Ohio. **Circle 389**

Punch Press

Jobs requiring unusual vertical or horizontal die space can be handled with a Series 90 8-ton power punch press. Three shut heights—7¾, 10¾ and 13¾ in.—are available. Down-



stroke is 1¼ in. Strokes of from 1 to 3 in. can be supplied on order.

The press operates at 180 to 190 spm on a direct drive using a ½-hp, 1725 rpm motor. Bed area is 8 x 11 in. with a 12-in. clearance between center of slide and frame.

The OBI machine is available in direct belt drive and back geared models.

Benchmaster Mfg. Co., Gardena, Calif. **Circle 390**

Mold Release Oil

Developed to meet the requirements of die-casting, a mold release oil prevents adhesion of casting metal to the die mold, gives bright stain-free casting surfaces and produces castings with less porosity. The oil develops comparatively less fog during die-casting operations and its lubricating effect mini-

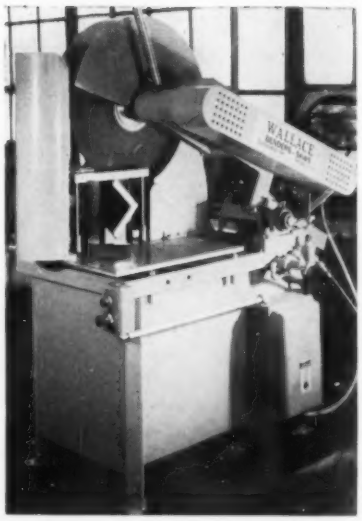
mizes wear on guide pins and bushings. It should be applied by the spray method.

Sun Oil Co., Industrial Products Dept., 1608 Walnut St., Philadelphia 3, Pa. **Circle 391**

Abrasive Cutting Machine

Modular Cut-Machining units are available with four sizes of cutoff wheels: 16, 18, 20 and 26-in. diam. The machine will handle flange beams up to 8 x 8 in. x 69 lb; 8-in. extra heavy pipe; and 5-in. round or 4-in. square solid bars.

Wallace Supplies Manufacturing Co., 1304 Diversey Parkway, Chicago 14, Ill. **Circle 392**



Safety Control for Injection Molders

When dies are not closing properly, an electronic control unit automatically stops an injection molding machine from applying clamping pressure, thus protecting molds, reducing downtime

and materials waste without slowing the machine's normal molding cycle.

The Circuit-Master Automold receives information from two sources—a pressure sensor fastened to the die cylinder and a position sensor mounted on the mold. The unit requires no settings or adjustments after initial setup and automatically compensates for expansions due to temperature and mechanic changes.

Wintriss, Inc., 20 Vandam St., New York 13, N. Y. **Circle 393**

Mercury Arc Lamp

Approximately five times the light intensity of the brightest tungsten filament lamp is provided by a new high pressure mercury arc lamp. The unit is interchangeable with the standard light source of J & L 14-in. or 30-in. comparators. It provides sharp black-and-white shadow at highest magnifications for accurate inspection and measurement.

Jones & Lamson, 510 Clinton St., Springfield, Vt. **Circle 394**

Magnetic Sump Strainer

Designed to meet the new JIC specifications for magnets in hydraulic systems, this sump strainer has built-in circular magnets placed between the removable filter disks at specific intervals. In a dual filtering action, screens remove nonmagnetic matter and the rest of the unit traps iron filings. When disassembled, magnetic particles drop

off the disk covers. With the combination magnetic trap and strainer, no extra openings in the hydraulic reservoir are required and no other components are needed.

Ripley Screen and Strainer Co., Filter Div., 32749 Northwestern Hwy., Farmington, Mich. **Circle 395**

Comparator; Calibration Kit

Wilder small parts comparator, Model C, is designed for the rapid inspection of mass-produced parts with stage and screen placed to provide maximum speed and comfort in inspection. A variety of magnifications, measuring stages and master gage charts is available to fit requirements of parts to be inspected. The comparator illustrated is equipped with a 2 x 4-in. measuring stage with window reading micrometers in 0.0001 in. **Circle 396**

Also available is a kit for the calibration of any make of optical comparator. The set consists of a 2 x 2-in. Leitz master stage micrometer and a 14-in. gage Deep-Etch comparator scale, packaged in a mahogany case. The stage micrometer carries 16 graduations in 0.100 in. and two reference marks of 0.625-in. distance. **Circle 397**

Opto-Metric Tools, Inc., 137 Varick St., New York 13, N. Y.

Carbide Fluted Tools

A line of solid carbide fluted tools includes burs, internal grinding tool, boring tools, reamers, drills and routers.

Burs of 46 shapes and sizes up to ½ in. diam are available with six types of cutting surfaces. Internal grinding tools include 17 sizes up to ⅜-in diam. Boring tools are made in 10 sizes from 0.090 to 0.360-in. minimum hole diam. Reamers with straight, right and left hand spiral flutes are within the size range of 1/16 to ⅜-in. diam. Flat drills range from 3/32-in. to ½-in. diam; drill and countersink combinations from ⅛-in. to ½-in. diam. Standard spiral drills are made in 1/64-in. steps from 1/16-in. to ½-in. diam, and in 60 wire gage sizes. Routers are profiling and straight.

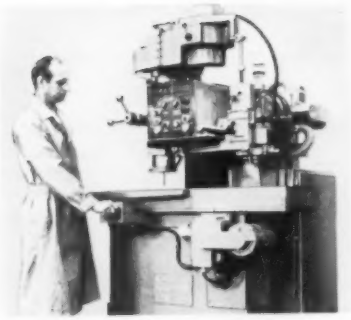
Kennametal Inc., Latrobe, Pa. **Circle 398**

Profiler Miller

This Magnetrace machine is built specifically for 360-deg profile milling under tracer control. The profiler follows a sheet steel template and can reproduce complex, irregular two-dimensional shapes.

The tracer system requires a stylus deflection of 0.0002 in. to activate the table and cross head drives. The machine is equipped with a 5-hp spindle drive and provides seven speed changes with a total range of 375 to 5200 rpm. Feed is up to 80 ipm.

Tooling required is a suitable work-



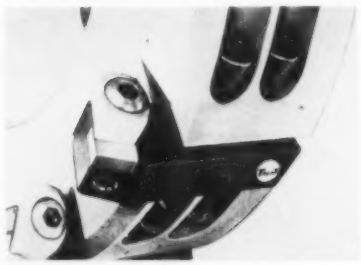
holder, a mild steel template and a tracer stylus of the same diameter as the cutter.

Pratt & Whitney Co., Inc., West Hartford 1, Conn. **Circle 399**

Cutter Blade Holder

Downtime is cut by the accessibility of the clamp locking screw in this cutter blade holder for disposable inserts. With the screw on the outside periphery of the milling cutter, the operator can index or change the inserts of cutters with two wrench motions, to loosen and relock the insert.

The blade design is available in a negative rake style with the following edge angles: radial rake, —7 deg; axial rake, —7 deg; peripheral clearance, 7 deg; and face clearance, at nose radius, 7 deg.



The blade holder is designated T-Max 270. 1-1822.

Sanvik Steel, Inc., 1702 Nevins Rd., Fair Lawn, N. J. **Circle 400**

Photopositive Paper

The high contrast of a direct photoprint paper clarifies mechanical drawings. Sharp copies can be made directly from positive originals. No negatives are needed.

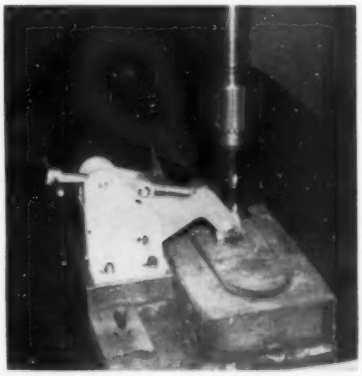
Extra-thin, 100 percent rag content paper or extra-strong vellum is available. Both may be processed in ordinary room light using standard photographic solutions. Both are of uniform quality and produce clear, sharp intermediate prints or printing masters. The paper makes wet-erasable prints ready for redrawing with pen or pencil.

Eugene Dietzgen Co., 2425 N. Sheffield Ave., Chicago 14, Ill.

Circle 401

Machine Clamp

A clamping range of —½ to +2¼, quickly adjustable without wrenches, tools or pipes, is available with this machine clamp. It exerts pressure up to 1500 lb by hand tightening. Application is not affected by material thickness or variance. The self-cleaning clamps are suitable for light duty milling, drilling and other operations on T-slot base machines.



General Alliance Corp., 2105 Moore St., San Diego, Calif. **Circle 402**

High-Speed Drills

Designed for production drilling of hard materials commonly used in the aircraft and missile industries, these tools are made of eight percent cobalt

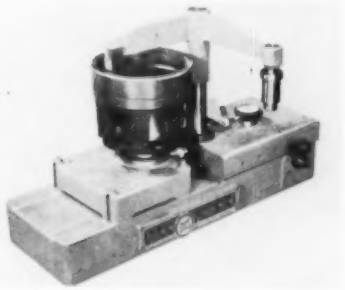
high-speed steel and have a split point for fast accurate penetration and short flute length for high rigidity. The flute design affords maximum chip clearing and cutting efficiency.

Of jobbers length, the series is available in sizes from 7/64 through 3/8 in.; No. 1 through No. 40; and letter A through U.

Whitman & Barnes, 40600 Plymouth R., Plymouth, Mich. **Circle 403**

Inspection of Internal Gears

Checking of internal spur and helical gears can be done with this Red Ring Model GRB unit. The gear to be checked is mounted on a fixed base. The moveable slide unit carries the

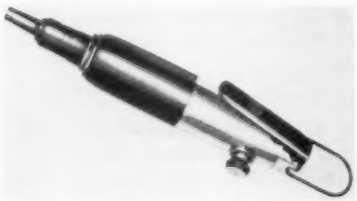


master gear mounting and the indicator, which shows center distance variation resulting from errors in the gear being checked.

National Broach & Machine Co., 5600 St. Jean St., Detriit 13, Mich. **Circle 404**

Power Screwdriver

Designed to reduce exhaust noises, this air-powered screwdriver is compact, quiet and comfortable in operation. The tool has a 5-vane motor, dual speed throttle, built-in lubricator and speed regulator. Three clutches and pistol grip or lever throttle handle



styles are available in reversible and nonreversible models.

Maximum capacity of all sizes is No. 12 free-running or No. 8 self-tapping screws. Weight varies, depending on model and handle style, from 1½ to 2⅝ lb. Over-all length is from 7⅞ to 10¼ in.

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y. **Circle 405**

Tube Rods

Copper-coated, coiled tube rods for semiautomatic open-arc hard-facing are available in a drawn size of 7/64-in. diam. The rod contains an internal flux for open-arc deposition and sound, slag-free deposit. It is continuously fed, eliminating breaks in the operation to change electrodes.

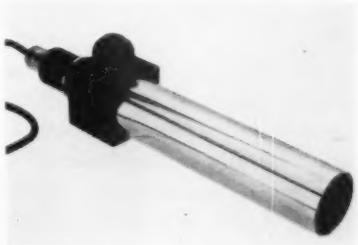
Small diameter of the tube rod allows use of high current densities and results in high deposition rates. As much as 15 lb can be deposited in an hour.

Haynes Satellite Co., Div. of Union Carbide Corp., 420 Lexington Ave., New York 17, N. Y. **Circle 406**

Autocollimator

Compact, lightweight, with an over-all length of 14⅞ in., this instrument meets specific autocollimation requirements in product quality control work. It has an interchangeable light source and eyepiece for viewing from end or side. Barrel diameter is NAS 900 standard 2.2398/2.2493.

Constructed of corrosive-resistant materials, the instrument can read precise



angles to 10 sec, has a power of 20 and a total useful field of four deg.

Tinsley Laboratories, Inc., 2526 Grove St., Berkeley, Calif. **Circle 407**

Stainless-Steel Strip

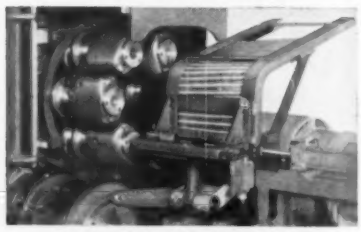
Straight chromium stainless-steel strip, Uniloy 435, provides greater workability than Type 430 when used in stretch bending and deep drawing. Surface characteristics and corrosion resistance are equal to Type 430.

Improvement in physical properties is obtained by a small alloy addition.

Universal-Cyclops Steel Corp., Bridgeville, Pa. **Circle 408**

Second Operation

MAGAZINE LOADING



REAR LOADING MAGAZINE

HAND LOADING

A Method of Machining That Pays Off

Greenlee standard Automatic Bar Machines, adapted for second operation work, profitably machine a wide variety of parts. Long shafts or short pieces are automatically loaded into the work spindle by any of the various loading arrangements shown. Parts are loaded in one position during the machining cycle, and machined in the remaining five cross slide and end working positions. For more information, see your Greenlee Distributor.

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- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Die Casting Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

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JANUARY 1960 **FOR FREE INFORMATION** CIRCLE KEY NUMBER

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1	11	21	31	41	51	61	71	81	91	101	111	121	131	141
2	12	22	32	42	52	62	72	82	92	102	112	122	132	142
3	13	23	33	43	53	63	73	83	93	103	113	123	133	143
4	14	24	34	44	54	64	74	84	94	104	114	124	134	144
5	15	25	35	45	55	65	75	85	95	105	115	125	135	145
6	16	26	36	46	56	66	76	86	96	106	116	126	136	146
7	17	27	37	47	57	67	77	87	97	107	117	127	137	147
8	18	28	38	48	58	68	78	88	98	108	118	128	138	148
9	19	29	39	49	59	69	79	89	99	109	119	129	139	149
150	160	170	180	190	300	310	320	350	360	370	380	390	400	701
151	161	171	181	191	301	311	321	351	361	371	381	391	401	702
152	162	172	182	192	302	312	322	352	362	372	382	392	402	703
153	163	173	183	193	303	313	323	353	363	373	383	393	403	704
154	164	174	184	194	304	314	324	354	364	374	384	394	404	705
155	165	175	185	195	305	315	325	355	365	375	385	395	405	706
156	166	176	186	196	306	316	326	356	366	376	386	396	406	707
157	167	177	187	197	307	317	327	357	367	377	387	397	407	
158	168	178	188	198	308	318	328	358	368	378	388	398	408	
159	169	179	189	199	309	319	329	359	369	379	389	399	409	

INSIDE FRONT COVER — INSIDE BACK COVER — BACK COVER

Where more than one catalog or product is featured, indicate the key number and product information preferred: Key No..... Product.....

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152	162	172	182	192	302	312	322	352	362	372	382	392	402	703
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154	164	174	184	194	304	314	324	354	364	374	384	394	404	705
155	165	175	185	195	305	315	325	355	365	375	385	395	405	706
156	166	176	186	196	306	316	326	356	366	376	386	396	406	707
157	167	177	187	197	307	317	327	357	367	377	387	397	407	
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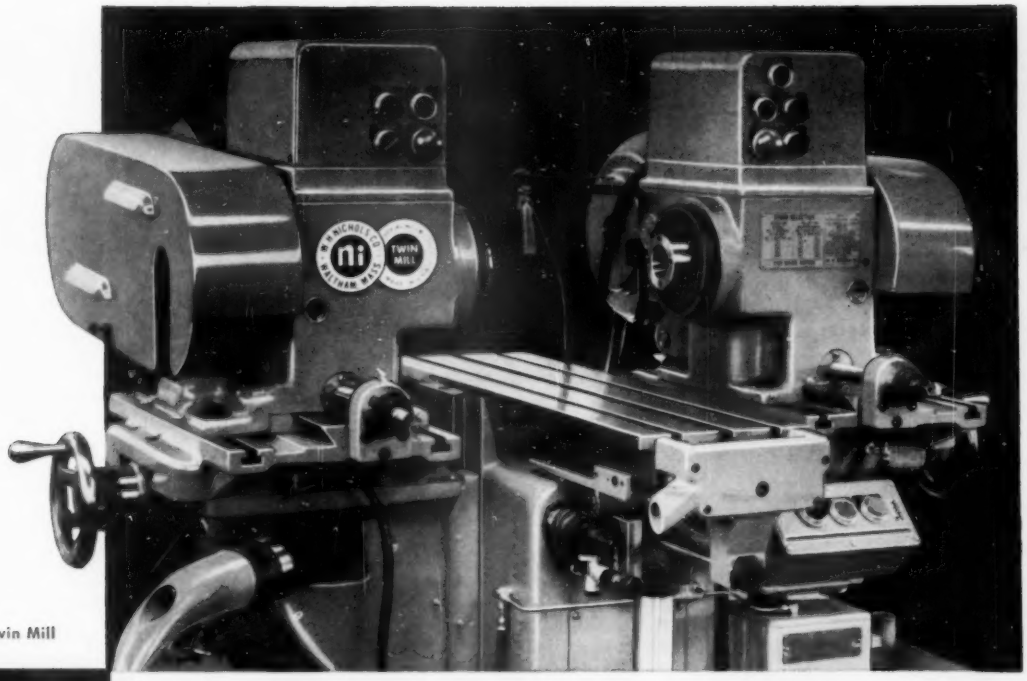
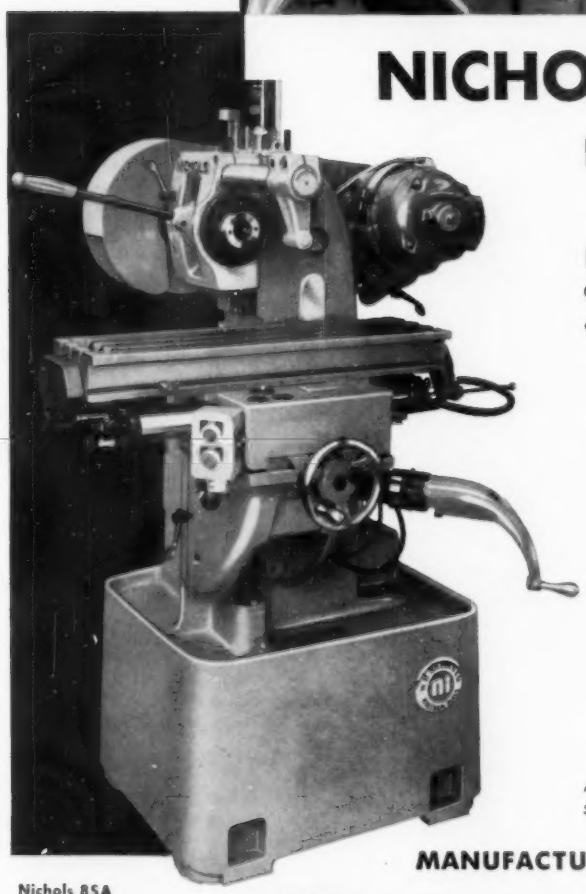


Twin Mill



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Trade Literature

for free booklets and catalogs—use request card, page 173

Snagging Wheels

General catalog PG-356 describes the features and proper selection of snagging wheels for swing frame, floor stand and portable grinding. It includes a section on grinding operation costs, safety practices with snagging wheels and a complete table of starting grades for rough grinding operations.

Cincinnati Milling Products Div., Cincinnati Milling Machine Co. **Circle 301**

Grinding Wheels

Describing the desired characteristics of disk wheels, a four-page color brochure also provides performance records on various disk grinding operations. The literature is illustrated with photographs of various sizes and types of disk wheels including perforated-slotted multiple-graded disc wheels. Wheel recommendations for cutting a wide range of materials are also included.

The Macklin Co. **Circle 302**

Die Heads

Die Headlines, Vol. V. No. 2, titled "Useful Information For The Screw Machine And Estimating Departments," includes information tables such as weights per ft of round, square and hexagon bars in steel, brass and aluminum screw stock in sizes from 1/16 to 3 in.; number of ft per thousand pieces for squares and hexagons; equivalent rpm for surface feet from 15 to 200; revolutions required for different feeds per revolution and lengths of feed; the production per hour for different seconds to take (gross, 80% gross, and 70% gross); hours required for 1000 pieces at these different rates of production; and table giving the pitch in decimal in. and depth of thread from 4 to 80 threads per in. Also included are "rules of thumb" on screw threads, tap drills and similar subjects.

The Eastern Machine Screw Corp. **Circle 303**

Furnace Brazing

Advantages, design, materials, brazing medium supporting fixtures, protective atmospheres and temperatures used in furnace brazing are described in a 16-page bulletin, No. 592. Illustrated, the material includes diagrams of typical assemblies and suggested "do's" and "don'ts."

The Electric Furnace Co. **Circle 304**

Abrasive Blast Cleaning

Catalog No. 594 is a guide to pressure type abrasive blast cleaning operations, as well as a catalog of machines and accessories. The literature contains information on both open top and closed top pressure type sandblast machines; nozzle bore sizes to compressor capacities; and operator accessories. It also introduces data on a high velocity blast nozzle which multiples the surface area coverage that can be cleaned compared to ordinary nozzles and without equipment or abrasive alterations.

Sandstorm Mfg. Co. **Circle 305**

Gap Lathe

Bulletin 211, an illustrated, 10-page booklet describing Model HXB 26/45, gives features and specifications on a heavy duty extension bed gap lathe.

Nebel Machine Tool Corp. **Circle 306**

Roller Bearings

HJ series roller bearings, with a patented one-piece cage design, are described in detail in catalog No. 359. Cage design permits use of the bearings at speeds higher than possible with conventional full complement roller bearings. Longer and larger rollers increase load capacities. The bearings are furnished with or without inner

Trade Literature

rings. Without inner rings, they may be applied directly to hardened and ground shafts.

Boundary dimensions of the series conform to AFBMA Series NAA and NAB. The bearings are interchangeable with needle bearings made to these standard inch-size dimensions. Bore sizes range from ¾ to 4 in.

The Torrington Co. **Circle 307**

Grinding Wheel Safety

Information contained in a wall chart, which lists 10 "do's" and 10 "don'ts" for grinding wheel operator safety, is based on the rules and regulations established by the American Standard Safety Code for The Use, Care, and Protection of Abrasive Wheels, B7.1-1956. The chart is suitable for display in tool rooms, on bulletin boards and in the grinding machine area.

Grinding Wheel Institute. **Circle 308**

Ball Bearings

New AFBMA ball standards, cross referenced to the previous ones dated July 1956, are listed in a precision ball catalog which also contains a master table of ball grades and tolerances. Another feature is the Quick Ball Selector Chart which offers a comparison of various ball materials and their relative rating for specific applications. It lists comprehensive data on balls manufactured of high carbon chrome alloy, stainless steel (Types 440C and 302), K-monel, aluminum, brass and bronze, carbon steel, glass, plastics (nylon, teflon), and other balls of special materials. Information includes both general application and specific material characteristics, mechanical properties, resistance factors, machinability, hardness, size, weight, and quantities per pound and per shipping container.

Hartford Steel Ball Co. **Circle 309**

Air-Hydraulic Boosters

New 24-page, three-color, engineering bulletin B-200P illustrates and describes how air-hydraulic boosters convert shop air into intensified hydraulic pressures for operating hydraulic cylinders and other hydraulically operated devices. The 24-page, three-color bulletin contains pricing, mounting and dimensional data on popular models and sizes. Two pages illustrate how boosters can be used in place of pumps and large bore air cylinders.

Also included are four pages of actual field applications of the boosters; a chart for quick, economical booster selection; a simplified method of calculating boosters; detailed circuits demonstrating the operation of the booster air-oil circuit in its low pressure approach stroke, high pressure working stroke, and return stroke phases; and a detailed explanation of the air-savings that can be obtained.

Miller Fluid Power Div. Flick-Reedy Corp. **Circle 310**

Ball Bearing Units

Catalog No. 60 describes a compact cast iron pillow block, 4-bolt and 2-bolt flange units, and take-up units and frames. The units are available with sealed precision ball bearing cartridges in shaft sizes from ½ through 2 7/16 in., or with low-cost sealed commercial ball bearing cartridges in shaft sizes from ½ through 1½ in.

Also illustrated are commercial sealed ball bearings including a stamped flange series with mounting dimensions interchangeable with standard precision assemblies, and a pressed steel take-up bearing and frame.

Roberts Mfg., Inc. **Circle 311**

Fluid Power Equipment

Bulletin 1005-H includes specifications, illustrations, references and descriptive matter on a line of fluid power equipment. Included in the listings are variable delivery one and two-way pumps with numerous controls (sizes 1-150); constant delivery (sizes 1-150), duplex (sizes 4-60), and automatic feed pumps; constant displacement, variable displacement, reversible motors (sizes 1-100); variable speed one and two-way transmissions (sizes 11-2020); standard 2000 psi and heavy-duty 3500 psi cylinders (2 to 8 in. bore); servo-control presets, amplifiers, panels and servo values for electrohydraulic systems; 2

Trade Literature

and 3 way pilot and directional valves; 3 and 4 way pilot valves; 3 and 4 way panel, flange and combination ported valves; relief and foot valves; surge valves 3 to 16 in. with standard operators; combination and differential, valves; as well as other fluid power accessories.

Oilgear Co. **Circle 312**

Ultrasonic Cleaning

Alkaline and acidic detergents are frequently better for ultrasonic cleaning than the more viscous solvents. This is one of the six practical tips given in a service bulletin which describes the process by which high frequency sound waves impart intense scrubbing action to solutions to speed precision cleaning. The bulletin describes compounds which have proved effective, and the types of operation ultrasonic cleaning does best.

Oakite Products, Inc. **Circle 313**

Stud Welding Fasteners

Designs and specifications for stud welding fasteners, the stud welding system, and engineering data and stud welding fastener specifications are detailed in a 48-page illustrated book.

Each standard specification page is similar to an engineering drawing, complete with dimensions, typical use description, ordering and specifying information. Weight charts, special machining operations, pictures and descriptions of standard stud welding equipment are shown.

K S M Products, Inc. **Circle 314**

Variable Speed Belts

Catalog VSB-1 is a 32-page belt selection guide for variable speed users. In addition to ratings, sizes and engineering data, the book provides reference information including alphabetical listings of applications; numerical listing of manufacturer's part numbers; numercial listing of applications; and variable speed cross reference tables.

Maurey Mfg. Corp. **Circle 315**

Lock Screw Locating Jig

Engineers, shop personnel and purchasing agents can locate precise location for drilling and tapping of lock screws with a plastic unit designed to locate all sizes of A.S.A. and Acme lock screws. In using the tool, the proper radius is fitted into the milling of a slip fit bushing and the exact location for drilling and tapping is then readily provided by the center punch.

Acme Industrial Co. **Circle 316**

Hydraulic Cylinders

To assist engineers, designers and production executives in selecting and specifying hydraulic cylinders, a catalog engineering guide, No. 117, for a line of interchangeable high-pressure hydraulic cylinders, features a fold-out arrangement of mounting diagrams with dimension charts, ordering information and parts list.

Features and performance data on the high-pressure hydraulic cylinders are illustrated and described. Hydraulic pressure and flow data, a simplified explanation for calculating the forces required for acceleration and deceleration, and the figures and table to determine oversized rod and stop tube applications are also presented in the 12-page 2-color catalog.

S-P Mfg. Co. **Circle 317**

Steel Analyses

Compositions of forty stainless steels, 184 alloy steels and 105 carbon steels most often used in industry are listed in a pocket-size, 20-page guide. It also contains federal specifications with corresponding SAE, AISI and AMS numbers.

Stainless and Strip Div., Jones & Laughlin Corp. **Circle 318**

Drill Unit

Designed as a "building block" component for assembly into automatic machines custom engineered to meet specific production requirements, model 17-400 is described as an air hydraulic drill unit that features versatility and adaptability, with quick, positive adjustment of all motions. The circular describing the unit covers construction and design

Trade Literature

details and advantages, and includes full specifications, dimensions, and other data. A large number of illustrations, both photographs and engineering drawings, are also included.

The Hartford Special Machinery Co. **Circle 319**

Welding Equipment

Manual welding equipment is covered in a catalog F-8982E. Manual torches in the Heliarc line are illustrated. Accessories available for each torch are described in the torch section of the catalog, and are also listed separately in table form. Complete ordering information is included.

The equipment described is suitable for manual welding of all commercial metals, ranging from thin-gage to ½ in. thick. Weldable metals include titanium, nickel, silicon-bronze, magnesium, aluminum and galvanized steel.

Linde Co. **Circle 320**

Die Setting

An article in "Die Set Digest" describes the many activities of die set manufacturers and is planned to help die set users in the performance of their jobs. It calls attention to such aids as printed die set templates, decimal equivalent charts, die spring load comparison charts, and offers individual help in designing unusual one-of-a-kind sets for special applications. New bushing attachments, which clean and lubricate guide pins in operation, are announced in the publication.

The Producto Machine Co. **Circle 321**

Turret Drilling

"Drama In Drilling," a booklet of case histories of applications on turret drilling machines, is a compilation of typical applications. Tooling employed, operations and time required are covered.

Applications include random hole patterns in one, two and many planes; concentric bolt circles (flat surfaces and at different angles); and straight line hole patterns, with photographs of tooling and drawings of parts.

An explanation of the principles of turret drilling and a description of the company's tooling clinic are also included.

Brown & Sharpe Mfg. Co., Turret Drilling Div. **Circle 322**

Power Convection

Heat treating furnaces in which the principle of power convection is used are described in an 8-page, two-color folder. Applications of power convection systems which are achieving unprecedented rates of heat transfer are shown photographically. Schematic flow diagrams of typical power convection systems are reproduced.

Surface Combustion Corp. **Circle 323**

Comparator

Bulletin F describes a lightweight portable comparator. Model B2 is illustrated in two positions: with its angle support leg extended to tilt it 20 deg for comfortable, parallax-free viewing, and with the support folded into the cast-aluminum base. Also shown is the Em-re dial indicator.

The bulletin lists the four A.G.D. dial gage sizes, capacities and ranges available for Model B2, and describes the physical specifications of the instrument.

Petz-Emery, Inc. **Circle 324**

Counting Devices

Advantages to be gained by including counting devices in the design of machinery are described in an 8-page flyer which includes illustrations of various counters, and mentions briefly some of the benefits obtained through incorporation of mechanical, electro-magnetic and photoelectric counters in modern machinery. Included in the descriptions are revolution counters, geared counters, ratchet counters, and types featuring high speed, reset, lineal measuring, remote data readout, predetermining of quantities or other quantitative data, and computation of varied coordinates.

Veeder-Root, Inc. **Circle 325**

Plant Layout Models

An illustrated catalogue describes the uses and the savings that can be realized from utilization of models in plant layout work. All phases of the model design and construction are shown, including how to estimate cost. A stock of over 5000 machine tool models plus information on some 20,000 more are available.

Visual Plant Layouts, Inc. **Circle 326**

Jig, Fixture Components

"Everyday Standards" a jig and fixture catalog, includes removable flat sheets of tracing templets particularly useful to the designer. Some 490 templet drawings are shown with over 90 percent of them in full size. The templets enable the designer to compare and select quickly the right size fixture or part for the right purpose. All templets are printed in red ink for extra visibility and easy tracing.

Items illustrated are grouped in the following sections: jig feet and jig legs; tool room screws and bolts; flange

nuts, washers and locaters; hand knobs, levers, keys, toggle pads; clamp straps and assemblies; miscellaneous types of nuts, washers, studs, bolts; box jigs (aluminum and cast iron); mill fixture bases; chuck jaws; and "T" angle plates.

Standard Parts Co. **Circle 327**

Tapping Guide

A slide chart called the "Tap Selector" allows the user to quickly select the correct tap for most tapping jobs. It indicates the proper size to use for a desired class of fit, the tap drill size, theoretical percentage of full thread, tapping speeds, lubricants for various materials and the correct style tap to use for through or bottoming holes.

Jarvis Corp. **Circle 328**

Hot-Work Steel

High-strength steel for use in aircraft, missiles and rockets is described in "Potomac A High Strength Steel." The 24-page booklet contains numerous graphs and charts on this chromium-molybdenum-vanadium hot work steel. Known as type H-11, the steel has strength up to 1000 F, and is used in landing gears, solid propellant rocket cases, structural sections of aircraft and missiles, and many other applications. Allegheny Ludlum Steel Corp. **Circle 329**

Optical Equipment

A 25-page illustrated catalog, "Optical Tooling and Industrial Alignment Equipment," covers a line of equipment for production tooling, machine alignment, quality control and inspection. Technical descriptions and specifications for all equipment are provided.

Equipment shown and described in the catalog includes jig transits, alignment telescopes, collimators, sight levels and a line of sight telescopes. Also covered are instrument testing equipment, surveying instrument micrometers, instrument stands; lamp housings, mounting accessories and brackets; target holding and centering equipment; and scales, tapes, targets and mirrors. Keuffel & Esser Co. **Circle 330**

Die Protection

The Circuit Master Mark III overload detector that eliminates die damage due to overload, misfeed, buckling, pile-up, end-of-material or other malfunction is described in a four-page bulletin. Designed to protect the entire die, this low-cost electronic unit operates completely automatically.

The die protection unit may be used on power presses or other reciprocal motion equipment where the closed position of the dies are fixed or of consistent shut height. Features, applications and installations are illustrated and diagrammed in the bulletin. Wintriss, Inc. **Circle 331**

Superalloy Performance Data

Two technical bulletins covering performance data on vacuum induction melted Udimet 700 and Udimet 41 superalloys include alloy description and chemical composition, physical constants, tables and charts on mechanical properties, isostress curves, and information on heat treatment and finishing. Metals Div., Kelsey-Hayes Co. **Circle 332**

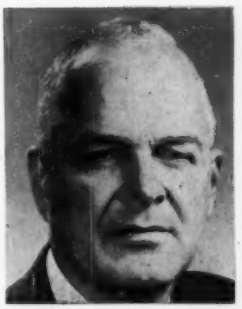
Precision Balls

Bulletin BU-1 presents the company's line of precision balls and discusses raw ball materials, methods of manufacture, precision, finish, sizes and quantities. Included are standard balls of such materials as tungsten carbide, synthetic sapphire, nylon, and M-10 high-speed steel; their physical and chemical properties and recommended uses.

The eight-page bulletin contains a listing of special and modified balls. Industrial Tectonics, Inc. **Circle 325**

Kermit Kuch, left, has been elevated to the position of executive vice president of The Monarch Machine Tool Co. A graduate engineer, Kuch joined the company 35 years ago. Beginning in the shop, he moved up through the company and, in 1943, was appointed chief engineer. He became vice president-engineering in 1947 and a board member in 1955.

C. E. Huddleston, right, recently appointed chief engineer, has been elected executive vice president by the board of directors of The Cleveland Punch & Shear Works Co. Huddleston received his degree in mechanical engineering at Cornell University in 1929 and has been connected with the metal-working and welding industry since that time.



Men at Work

Two personnel promotions, marking the expansion of the development section of National Electric Welding Machines Co., have been announced. PAUL THORNE, formerly chief electrical engineer, has been named chief electrical and development engineer. His new duties involve development of electronic applications in the building of automated welding machines. He will also be in charge of the laboratory and samples section. HAROLD BACH, 20-year veteran with the company and former manager of the service and research section, has been named chief welding engineer. Bach will remain in charge of service and test and will serve as consultant liaison between engineering and test activities.

EDWARD N. HARRIS has been appointed manager of Bohn Aluminum & Brass Corp. Plant No. 12, South Haven, Mich. He formerly supervised Bohn's sales and engineering contacts with several General Motors manufacturing divisions. ROBERT W. JOHNSTON has been appointed to supervise the accounts formerly handled by Harris.

RICHARD A. LEE acting manager of the Rawson Centrifugal Clutch Div., O. S. Walker Co., Worcester, Mass. prior to its purchase in September by the Formsprag Co., has joined Formsprag as application engineer. He will work with customers in adapting the Rawson centrifugal clutch to the products which they manufacture.

M. R. MCLARY has been elected executive vice president and manager of the Ingersoll Products Div., Borg-Warner Corp. McLary has been with Ingersoll Products since 1952, starting as chief engineer. Subsequently he was advanced to other managerial assignments, including director of engineering and research, production manager and works manager. Prior to joining Borg-Warner he was master mechanic of the Airtemp Div. of Chrysler Corp.

Bendix Aviation Corp. has announced the appointment of M. J. KENNEDY, of Grosse Pointe Park, Mich., as general manager of the Bendix Filter Div. at Royal Oak, and HARRY STOLAR of Loudonville, N. Y., as general manager of

Walter H. Venghaus, specialist in manufacturing and fiscal control, has joined The Narda Ultrasonics Corp. as vice president and manager of manufacturing. Venghaus has formerly been associated with National Research Associates, Inc., Flight Refueling, Inc., Reaction Motors, Inc., the Industrial Acoustics Co., Inc. and Frederick E. Anderson, Inc., a consulting firm.

John Powers has been appointed manufacturing manager of the Vernon Allsteel Press Co. He has been associated with the company since 1949 as a design engineer and most recently as chief field engineer, hot and cold forging equipment. He has been responsible for the field erection of special equipment including pipelines presses and forging lines, and like equipment.

Iden F. Richardson has been appointed manager of Hughes Products Group, the commercial division of Hughes Aircraft Co. He joined the company in August, after serving 23 years with Bendix Aviation Corp. Richardson succeeds Raymond P. Parkhurst, who has resumed his former title of vice-president-manufacturing. Parkhurst is an authority on electronics manufacturing.

Milton R. Watko has been appointed chief engineer of the Ransohoff Co., Hamilton, Ohio. He received his engineering training at Lawrence Institute of Technology and Butler University before going to work as an industrial engineer on finishing systems. Prior to his new appointment, Watko was chief engineer, Machine Div., International Conveyor & Washer Co.

Men at Work

the Marshall-Eclipse Div., Troy N. Y. FREDERIC C. WEYBURNE, formerly general manager of both divisions, has been named an assistant group executive of the corporation with headquarters in South Bend.

HOWARD S. BUNN has been elected a director of Tri-Continental Corp. Bunn is president of Union Carbide Corp. Tri-Continental is the nation's largest diversified closed-end investment company. Founded in 1929, it has assets of approximately $405,000,000.

The board of directors of the Gleason Works, Rochester, N. Y. has announced the election of LAWRENCE G. GLEASON to the office of president and general manager. He has been president since 1958. HOWARD F. CARVER was elected to the position of vice president and assistant general manager. He has served as a vice president of the company.

DONALD E. NOVY has been named production control manager at Republic Flow Meters Co., a subsidiary of Rockwell Mfg. Co. He will be responsible for scheduling production, inventory control, and developing manufacturing techniques.

Edward J. Ferris, Jr., right, has been named factory manager and Earl R. Lewis, left, production manager at the Pratt & Whitney Co., Inc. Ferris will be responsible for coordinating all manufacturing operations and Lewis for all production department activities within the company's machine tool, cutting tool and gage divisions.

Three major engineering appointments at the Utica div. of Bendix Aviation Corp. have been announced. HOWARD A. ALEXANDERSON, chief engineer at Utica since 1951, was named director of engineering. BERNARD GOLDBERG, executive engineer since 1954, was appointed chief engineer, current products. HENRY TROEGER, a supervisory engineer since 1956, was named chief engineer, advance design.

NORMAN C. PICKERING has been elected to the board of directors of Avien, Inc. He replaces HENRY W. BLACKSONE, president of Servo Corporation of America, who recently resigned. Prior to joining the company, Pickering served for two years as president of Charles Denning, Ltd. Sag Harbor, N. Y. From November 1945, to January 1957, he was president and director of research of Pickering & Co., Inc.

Appointment of RALPH A. OLSEN as a project engineer at the Formsprag Co., Warren, Mich. has been announced. Olsen most recently was a supervising engineer in the Chrysler Corp. Missile Div. where he was associated with the design and development of surface and underwater missile launching systems for ships and submarines. He assisted in the design of the air-eject launching system adopted by the U. S. Navy for the Polaris atomic-powered submarine. Earlier he was associated with Reid Research in Washington D. C.

FRED NELSON HURST has been named plant engineer for Raytheon Co. Semiconductor Div. plant now under construction at Lewiston, Me. Prior to joining Raytheon he served as plant engineer with Stowe-Woodward Inc., Sylvania Electric Co., United States Gypsum Co., and National Fireworks.

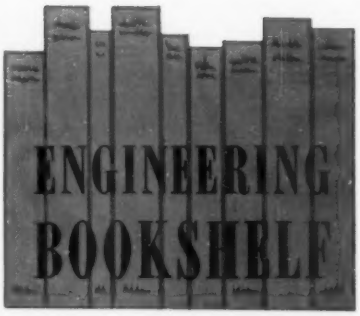
Henry M. Heyn, left, and Eugene P. Heilens, right, have been appointed vice presidents of the Midland-Ross Corp. Heyn will head up Surface Combustion, a division of Midland-Ross, with six plants and subsidiaries reporting to him. Heiles, formerly vice president and controller of Surface Combustion, will serve as general manager of the Toledo operation.

Men at Work

Alan C. Mattison, left, president of the Mattison Machine Works, Rockford, Ill., has been elected president of the National Machine Tool Builders' Association. Also elected to office at the recent meeting were Everett M. Hicks, first vice president; Francis J. Trecker, second vice president; Graham E. Marx, treasurer; and Grayson M. Stickell, secretary.

M. D. Ayers has been appointed director of engineering of Kennecott Copper Corp. He joined the organization in 1956 as assistant to the president. Prior to joining Kennecott, he was chief engineer of the Wheeling Steel Corp. Ayers served with U. S. Steel from 1933 to 1946, at which time he assumed the post of chief engineer, Hamilton Works, Steel Co. of Canada.

Bendix Aviation Corp., South Bend, Ind., has announced the appointment of FREDERIC C. WEYBURNE as assistant group executive in charge of six manufacturing divisions. Corporate divisions under Weyburne's direction will include Marshall-Eclipse at Troy, N. Y.; Eclipse Machine, Elmira, N. Y.; Zenith Carburetor and Bendix Filter, Detroit; Lakeshore, St. Joseph, Mich.; and Bendix-Eclipse of Canada, Ltd., Windsor.



PLANT ENGINEERING HANDBOOK—*By William Staniar, Editor-in-Chief—Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. Price $23.50. 2522 pages.*

This book is a compendium of industrial and engineering know-how designed to fill the need for a book which could be used to assist in solving the day to day problems in industrial plants and in design engineering. It presents, in compact form, material which appears in greater detail in specialized reference works. The information covers 92 major areas of plant organization, design, construction, operation and maintenance which show how individual plants can be run more efficiently and economically.

Among the 34 new subjects in this second edition will be found authoritative treatises on materials of construction for industrial buildings and chemical process plants, standardization of engineering practices, heating of industrial buildings, industrial painting, stationary diesel engines, a-c and d-c motors, industrial uses of carbon and graphite, automation, plastic asbestos piping, industrial rubber hose, aluminum brazing, high-speed gearing, oil-film bearings, industrial electronics and automatic weighing and proportioning. In all, the book deals with industry's consumption and conservation of basic resources through management engineering.

MACHINERY'S HANDBOOK, 16TH EDITION—*By Eric Oberg and F. D. Jones. Pubished by The Industrial Press, 93 Worth St., New York 13, N. Y. Price $11. 2104 pages.*

Revision to reflect changes in data and technology have resulted in the addition of 192 pages to this latest edition. The section on screw-thread systems has been revised to incorporate latest changes in screw-thread standards. Included are tables of dimensional data for all classes of Unified threads including the several new thread series

recently added and hole sizes for tapping Unified threads based on the new diameter tolerances.

New designations, applicable to ground thread taps, as well as recommended tap limits to achieve the various classes of fits in the Unified thread series are included. New sections have been added giving formulas and tables for curved beams such as are used in machine frames; round, rectangular and square plates; cylinders subjected to internal and external pressure; tubes and shells.

Involute splines and serrations are covered in a new 43-page section giving design data, formulas, and dimensions in tabular form for the design, production and specification of the various types of spline and serration fits. As an aid to the draftsman, several pages are devoted exclusively to detailed drawing specifications for the various types of splines and serrations.

Other new or revised subjects given coverage include strength of threaded connections, wire and sheet-metal gages, wire rope, tables of involute functions, fasteners, reamers, drills, keys, keyways, pins, miniature threads, studs, grinding, polishing and lapping, flat belts, V-belts and sheaves, transmission chains, knurls and knurling, single-point cutting tools, carbide-boring tools, welding, brazing, hard surfacing and metalcutting.

FLUID-POWER CONTROLS—*By John J. Pippenger and Richard M. Koff. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $9. 254 pages.*

This guidebook describes controls and valves for fluid-power systems from a practical standpoint.. Covered are construction and operation, proper use in hydraulic circuits, and maintenance. Each component is treated separately in respect to function, operation and uses. Various general types of circuits are discussed. Joint Industry Conference Standards are given along with ASME symbols for diagrams.

PRECISION VALLEY: THE MACHINE TOOL COMPANIES OF SPRINGFIELD, VERMONT—*By Wayne G. Broehl, Jr. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N. Y. Price $5.95, 274 pages.*

A history of three machine tool companies of Springfield, Vt., this book spans a seventy-year period of machine-tool history. It is a research study of the business-management problems of the three companies interwoven with the development of the industry and the country. The book transcends the elements of a research study and provides highly entertaining, interesting reading.

who's meeting and where

Jan. 7-8. Extension Div., Univ. of Wisconsin. Nondestructive Testing Institute. Wisconsin Center, Langdon and Lake Sts. Madison, Wis.

Jan. 11-13. Sixth National Symposium on Reliability and Quality Control. Statler-Hilton Hotel, Washington, D.C.

Jan. 12-15. Society of Plastics Engineers, Inc. Annual Technical Conference. Conrad Hilton Hotel, Chicago, Ill.

Jan. 15. Malleable Founders Society. Semi-Annual Meeting, Hotel Sheraton-Cleveland, Cleveland, Ohio.

Jan. 21-22. Extension Div., Univ. of Wisconsin. Industrial Power Systems Institute. Wisconsin Center, Langdon and Lake Sts. Madison, Wis.

Jan. 20-26. Institute of Surplus Dealers. Annual convention and trade show. N.Y. Trade Show Bldg., 8th Ave. and 35th St., New York, N. Y.

Jan. 25-28. Plant Maintenance and Engineering conference and show. Convention Hall, Philadelphia, Pa.

Jan. 25-29. America Standards Association. Gaillard Seminar of Standardization. Engineering Societies Bldg., New York, N. Y. Further information available from Dr. John Gaillard, 135 Old Palisade Rd., Fort Lee, N. Y.

Feb. 1-5. Instrument Society of America. Instrument Automation Conference and Exhibit. Rice Hotel and Sam Houston Coliseum, Houston, Texas. Further information available from William H. Kushnick, ISA, 313 Sixth Ave., Pittsburg 22, Pa.

Feb. 3-4. American Welding Society and Armour Research Foundation, Illinois Institute of Technology. Sixth annual Midwest Welding Conference. Illinois Tech Chemistry Bldg., 3255 S. Dearborn St., Chicago 16, Ill. Further information available from Harry Schwartzbart, Armour Research Foundation, 10 W. 35th St., Chicago, 16, Ill.

technical shorts

New Process For Coating Metals

Phosphatizing process which eliminates water solutions and economically applies protective phosphate coatings to metal parts was exhibited at the recent National Metal Exposition and Congress by the Du Pont Electrochemicals Dept. The phosphatizing process, linking vapor degreasing to spray-in-vapor painting in a complete metal-finishing system based on "Triclene" trichlorethylene, was shown operating in a plant-scale unit at the company exhibit. This compact machine was designed and fabricated by G. S. Blakeslee & Company, Chicago, which is cooperating in the development.

In the new process, metal parts are given a phosphate coating by dipping or spraying with trichlorethylene-based phosphatizing solution maintained at its boiling point (188 F). As parts emerge from the trichlorethylene vapor zone after phosphatizing, the solvent evaporates leaving parts dry and ready for immediate painting.

The coating, as formed on steel, is a strongly adherent form of iron phosphate which provides an excellent paint base. Coating weights from 40 mg/sq ft to over 200 mg/sq ft can be achieved in from one-half to three minutes' time. Phosphate coatings can also be produced on other metals such as aluminum, magnesium and zinc. The new process will be commercially available in mid-1960.

* * *

High-Strength Aluminum Alloy

A patent covering an aluminum alloy which can be cast to the higher strengths necessary for advanced missile and aircraft components has been granted to North American Aviation, Inc. The composition of the alloy, which is called "Tens-50", makes it possible to produce stronger parts much easier and with less expense than is required with conventional alloys. The new alloy is now being specified for many aluminum castings in liquid rocket engines for advanced missiles and aircraft.

An important part of the new alloy's composition is beryllium which is added in small quantities. Ordinarily, during melting and pouring of metal in the casting process, iron impurities are picked up and castings become brittle. In the new alloy, the iron picked up is modified by the beryllium without impairment of the casting's strength. Automotive pistons, aircraft pylons, high-pressure values, hoist bodies, jack-hammer cylinders, high-speed impellers, compressor bodies and wave guides are some of the critically loaded parts that are now being economically produced with the new alloy.

* * *

Welding Galvanized Surfaces

Difficulty in welding a galvanized surface can be avoided by masking the weld areas with a solution of potassium dichromate and hot water prior to galvanizing. The solution is being used by the Westinghouse Electric Corp.'s lighting division in Cleveland, Ohio to leave a clean surface for welding on the bottom of transformer tanks. After welding, the ungalvanized surface is shot-blasted and zinc-sprayed.

The masking solution consists of 32 oz of potassium dichromate and one gallon of water. It is applied at a temperature from 120 to 140 F and is allowed to remain in contact with the metal for two minutes. The surface is then dried before galvanizing.

* * *

Impact Extruded Magnesium

Successful development of mass-production low-cost procedures for impact extrusion of small, closed-end magnesium battery cans with exceptionally thin walls and high length-to-diameter ratio has been reported by White Metal Rolling & Stamping Corp. These cylinders, now in production in a number of sizes, are being used as battery cans for military applications to utilize the higher voltages attained with magnesium. These voltages are approximately twice those of zinc cells. Lighter weight of magnesium is an additional advantage.

Pure magnesium or various magnesium alloys can be used in these impact extruded containers. Designers in other fields may find that the low cost and light weight of impact-extruded magnesium parts solve problems.

TOOL ENGINEERING *in Europe*

By M. Kronenberg

Consulting Engineer
Cincinnati 6, Ohio

Rigidity of Three-Jaw Chucks

Performance of machine tools is substantially affected by chuck rigidity, according to an article published by G. Pahlitzsch and H. J. Warnecke in *Zeitschrift des Vereins Deutscher Ingenieure*, Vol. 101 (1959), No. 25, p. 1167-1175 under the title: "Untersuchungen ueber die Steinfheit hand betaetigter Dreibacken Futter."

Accuracy and metal-removing capacity of lathes and other machine tools depend on the weakest member in the machine-tool-chuck-workpiece tool system. Chucks have received little attention in past machine tool research, despite the fact that clamping and cutting forces tend to deform the chuck, as do centrifugal forces and vibrations.

A chuck cannot clamp a workpiece securely when centrifugal forces increase beyond a certain limit. This is a problem with carbide and ceramic tools, which are operated at high speeds.

The static stiffness of three different types of chucks was investigated by the authors and found to be a criterion for the performance of the machine. Dynamic stiffness is not covered in this article and results will be covered at a later date. The investigation covered the radial stiffness and the tilting stiffness of the jaws and their guides, which was measured by applying a hydraulic load to the jaws to simulate clamping of a workpiece. The loading device consisted of a hydraulic cylinder with three pistons pushing accurately in a radial direction on the jaws. Strain gages were used for measuring the oil pressure and the load exerted on the jaws. Deformations caused by the load were determined by micro-indicators.

Radial stiffness is independent of the clamping diameter but varies with the position of the jaws with respect to the clamping mechanism. Stiffness stays constant as long as the greatest possible length or number of teeth of a jaw is in engagement. It is reduced when the

supported length of the jaws is decreased by moving the jaws toward the outside.

The weakest chuck was of the "plane curve" type and the strongest of the "gear screw" type, which was 100 percent stiffer than the plane curve type. The body of the gear screw type chuck was also stronger than that of the other chucks. Stress trajectories published in the article demonstrate the stress pattern in the body for chucking and after removing a workpiece.

Centrifugal forces acting on the chuck tend to open it up and thus to reduce the security of clamping. This reduction is influenced not only by the radial stiffness but also by the stiffness of the workpiece, the mass of the jaws, the distance of the jaws from the center of rotation and the square of the speed (rpm) at which the machine is running.

Clamping decrease was measured by inserting a steel ring, equipped with strain gages connected to a rotating slip ring, into the chuck. Depending on the design of the chuck and the speed of its rotation, the decrease in clamping force was as high as 15 percent of the originally applied clamping force. The gear screw type chuck was also the best chuck with regard to clamping force reduction (about 10 percent at 2000 rpm).

Turning and Milling

Equations for the wear of carbide tools are of the same order for both turning and milling operations, as shown in an article by L. Tschirf and E. Eder, published in *Zeitschrift des Vereins Deutscher Ingenieure*, Sept. 1959, p. 1189-1196. The title is: "Das Schnellzerspanen durch Drehen und Fraesen mit Hartmetall Werkzeugen."

This conclusion was derived from numerous formulas for tool life-wear land-cutting speed relationships. The authors also discuss the significance of tool geometry, and the relationship between angle of engagement, variation in chip thickness and wear at varying ratios of width of milling to the diameter of the milling cutter.

The unit metal-removal rate (cu in/min/hp) is also discussed and is in agreement with Kronenberg's finding that this quantity does not indicate tool life or machine performance, but is related to the unit cutting force (lb/in^2).

The authors, who are professors at Vienna University (Austria), also give a comparison of German and Russian carbide tools including their chemical compositions and fields of application.

American and German Die Steels

Based on a visit to American industries and a study of the die steels used

Tool Engineering in Europe

in the United States and Germany, an article by H. Hecht and H. M. Hiller in *Werkstattstechnik*, Vol. 49 (1959), No. 10, p. 645-648, is entitled: "Leistungsvergleich Amerikanischer und Deutscher Gesenkstaehle."

American steels, such as Pyrotem, Hardtem, Thermotem and Prestem are compared with corresponding German steels such as Standards 271¾, 2311, 2606 and 2365. The molybdenum content of Pyrotem is substantially higher than that of its German counterpart and hence the steel is superior in performance. A comparison of Prestem and German 2365 showed that the American steel did not contain chromium while 2365 contains 2.8 percent Cr. The authors describe the differences in heat treatment resulting from the difference in composition and conclude that this steel is not applicable to German production methods, although they admit that improvements in steel 2365 would be desirable as far as the resistance to wear is concerned.

Doctoral Theses

A list of Doctoral theses on tool engineering subjects was published in *Werkstattstechnik* for October, 1959. Their titles in English follow. The name of the university is shown in brackets.

K. Lange: Production Problems of Die Forging and Their Scientific Development. (Hannover)

H. Muehlenberg: Surface Roughness Changes in Drawing of Seamless Tubes with subsequent Cold Drawing. (Hannover)

F. Proksa: Theory of Plastic Bending of Sheet Metal at Large Deformations. (Hannover)

G. Roehlke: The Mechanics of Metal Cutting. (Karlsruhe)

H. Siebel: Research in the Milling of Steel with Carbide Cutters. (Aachen)

K. Loewenfeld: Stiffness of Machine Tool Elements. (Munich)

H. Soobel: Investigations of Seals Used in Machine Tools. (Stuttgart)

Th. Stoeferle: Research into Disk Clutches. (Stuttgart)

K. E. Wetzel: Contribution to Vibration Problems in Machine-Tool Spindles. (Stuttgart)

W. Opitz: Research into the Main Cutting Forces in Plunge Cutting Operations. (Aachen)

H. H. Schoenborn: Development of a method for Measuring Cutting Forces in the Milling of Wood. (Stuttgart)

O. Eggert: Development of Measuring Devices for Investigation of the Wear of Knife Edges. (Stuttgart)

Field Notes

Export-Import Bank of Washington has issued a credit of $34 million to assist Societa Elettronucleare Italiana (SELNI) in establishing the **Enrico Fermi Nuclear Power Plant** in northern Italy. Designed to permit an increase in output from the initial 165,000 kw of net electrical energy to 225,000 kw as reactor technology advances, the proposed plant is a heterogeneous pressurized reactor using light water as both moderator and coolant. Westinghouse Electric International Co. is providing the nuclear equipment and design, as well as the electric generator for the project.

new facilities

A new facility for the Midas Satellite system has been established at Cape Canaveral by **Lockheed Missiles** and Space Div., prime contractor for the program. The Midas program is intended to orbit satellites equipped with infrared sensing devices which will detect the high temperatures of intercontinental ballistic missile firings. Purpose of the Midas program is to provide the U. S. with an early warning system against ICBM attack. More than 100 scientists, technicians and administrative personnel are employed.

The Semiconductor Div. of Minneapolis-Honeywell Regulator Co. has announced plans for construction of a $1,000,000 research and development center at Riviera Beach, Fla. To be erected on a 15-acre tract in an industrial section known as Lewis Terminals, the 40,000 sq ft structure will be equipped for pilot production of newly developed products. Production of the company's existing line of transistors will continue in Minneapolis. The new Florida facility is expected to be ready for occupancy by early summer of 1960.

U. S. Transistor Corp. has opened its new plant in the Syosset Industrial Park, Syosset, L. I. U. S. Transistor will manufacture germanium alloy junction and silicon transistors, and other electronic products at the new facility for commercial and military use.

Heinemann Electric Co., Inc. of Trenton, N. J., announced plans for a new plant that will nearly double present manufacturing capacity. The firm is a major producer of circuit breakers, overload and time-delay relays for various types of equipment protection. Occupancy of the new plant is scheduled for the summer of 1960.

acquisitions

Chromalloy Corp. has entered the fields of Special materials for tool production and nuclear reactors through acquisition of Sintercast Corp. of America. Chromalloy Corp., a producer of special high-temperature-resisting alloys and solid propellants will operate Sintercast as a division. Sintercast Corp., founded by the late Erwin Loewy in 1947, has developed 25 patents in the field of metallurgy.

Dow Chemical Co. has announced that its Swiss subsidiary, Dow Chemie A. G., and The Rio Tinto Co., Ltd., of London, England, have jointly acquired the share capital of Thorium Ltd. from Imperial Chemical Industries, Ltd. and Howards of Ilford, former joint owners. Thorium Ltd., founded in 1914, is the principal processor of crude thorium materials in the United Kingdom.

Monrovia Aviation Corp., a wholly owned subsidiary of Carrier Corp., has been purchased by Telecomputing Corp., Los Angeles. Monrovia Aviation Corp. is engaged in the manufacture of aircraft sub-assemblies and ground-support equipment. Telecomputing will continue the operations of Monrovia as in the past with no changes in personnel comtemplated.

expansions

Corning Glass Works has established a new manufacturing department for production of ceramic parts primarily for the electronics industry. Headed by Philip C. Leffel, Jr., the new department will produce ceramic and sintered glass parts for products such as power, microwave and transmitting tubes and other electronic devices, as well as for industrial applications.

The Barden Corp., manufacturer of precision ball bearings, has completed a multimillion dollar expansion program in Danbury, Conn. The expansion enables the company to unite under one roof sales, engineering and purchasing departments which formerly were located in another part of the city. The new facilities are among the largest in the country devoted exclusively to design and production of instrument precision ball bearings.

Houghton Laboratories Inc., Olean, N. Y. has broken ground for a new addition to their Olean offices. The new building has been designed to house the company's marketing organization and will approximately double existing office space. The expansion program includes plans to remodel existing office space to permit installation of IBM accounting equipment. Houghton Laboratories Inc. operates plants in Olean. New York, Los Angeles and Toronto.

moves

Dearborn Rubber Corp., a distributer of mechanical rubber goods to midwestern industry has completed its move to new quarters at 2545 S. 25 Ave., Broadview. The move has enabled the company to increase its warehousing space by 50 percent over that of its former quarters in Chicago.

Bickley Furnaces, Inc., designers and builders of high-temperature furnaces and kilns, have moved from their previous quarters at Richard C. Remmey Son Co. in Philadelphia and are now operating in their new office and factory building. Located in suburban Philadelphia, the new plant has over 10,000 sq ft of floor space for development and construction of high temperature furnace equipment.

awards

Thomas F. Morrow, Chrysler Corp. group vice president has been selected by the board of directors of the American Rocket Society to receive a **1959 ARS Fellow** membership award. The award has been presented in recognition of Morrow's work in the field of rocketry and space flight. Two of the nation's missile systems, the U. S. Army Redstone and the Army-developed U. S. Air Force Jupiter, are built by Chrysler under Morrow's direction.

An official Naval commendation has been awarded Joseph D. Posner, project engineer for the **M & T Co.** of Philadelphia. Posner was commended for work on the design of a new, improved Socket Proof Tester and the

Field Notes

design and manufacture of two sets of Expeditionary Arresting Gear for the Marine Corps. The design of the Socket Proof Tester has been accepted by the Fleet and has received a commendation from the Bureau of Aeronautics.

Richard P. Moore president of Moore Special Tool Co., Bridgeport, Conn., is the first recipient of the **L. A. Sommer Memorial Award** created by the National Tool & Die Manufacturers Association. The award was presented by Philip R. Marsilius, a former president of NTDMA, at the 14th annual convention of the Association.

The annual **"Growth Company of the Year"** award of the National Association of Investment Clubs has been presented to Standard Pressed Steel Co. of Jenkintown, Pa. SPS is a major producer of a wide variety of fasteners for industrial and aircraft applications. Other products manufactured by the company include nuclear components, office furniture and shelving.

association news

A new, electronic metallurgical searching service with a 100,000-titles per hour capacity will be launched early in 1960 by the **American Society of Metals,** whose headquarters are at Novelty, Ohio, near Cleveland. The new facility, to be known as the ASM Metals Documentation Service, will "literally save thousands of dollars for those needing specific information on metallurgical problems," according to an announcement by Allan Ray Putnam, managing director of the Metal Society and former publisher of THE TOOL ENGINEER. The service is an outgrowth of four years of research and pilot plant experience in the field of indexing and machine searching.

The **National Society of Professional Engineers,** moving toward its goal of 60,000 members by 1960, gained its fifty-first state-level affiliate and its first student chapter at its annual fall meeting in Pittsburgh. More than 300 directors were present to see Vermont become the Society's fifty-first affiliate at the opening night's dinner meeting in the Penn-Sheraton Hotel.

Earlier, the University of Pittsburgh become the nation's first student chapter to become officially affiliated with the National Society. Victor J. Steigerwald,

president of the chapter, accepted the charter in ceremonies following the opening dinner.

Among newly elected officers of the **Investment Casting Institute** is R. F. Waindle, president of WaiMet Alloys Co. and past National President of the American Society of Tool Engineers who was elected ICI vice president, Technical Division. John H. Morison, of Hitchiner Mfg. Co. has been elected to the presidency of ICI, and R. E. Gray of Gray-Syracuse, Inc. has been elected vice president of the Institute's Management Division.

new activities

Boeing Airplane Co. has awarded three subcontracts for research and development work in the Minuteman intercontinental ballistic missile weapon system for erecting the missile and lowering it into its underground launch silo. The General Motors and Cessna Aircraft Co. projects involve the development of transporter-erectors for hauling the missiles to launching sites, and containers and carriages for the first-stage engines of the 6300-statute-mile-range missile.

A new liquid hydrogen facility is now in operation at the Tonawanda, New York laboratories of **Linde Co.,** Div. of Union Carbide Corp. The unit can produce more than 25,000 liters of liquid hydrogen per month. Termed "the ultimate chemical fuel" by Air Force missile experts, liquid hydrogen delivers approximately 40 per cent more specific thrust than any other known rocket fuel.

Overhaul and Repair Dept., Hamilton Standard, division of **United Aircraft Corp.,** has received a contract to overhaul 2400 U. S. Air Force propellers and controls. The propellers are for the Boeing KC-97 tanker used in refueling jet bombers of the Strategic Air Command.

Hamler-Lewis, Ltd., of Chicago and Cryogenics Div. of North Philips Co., Inc., of Mount Vernon, N. Y., will cooperate in marketing the new Norelco Ammonia-Gas Separator. Philips is responsible for development and production, Hamler-Lewis for sales and installation. The new machine employs a super-cold refrigerator to produce high-purity hydrogen and nitrogen gases.

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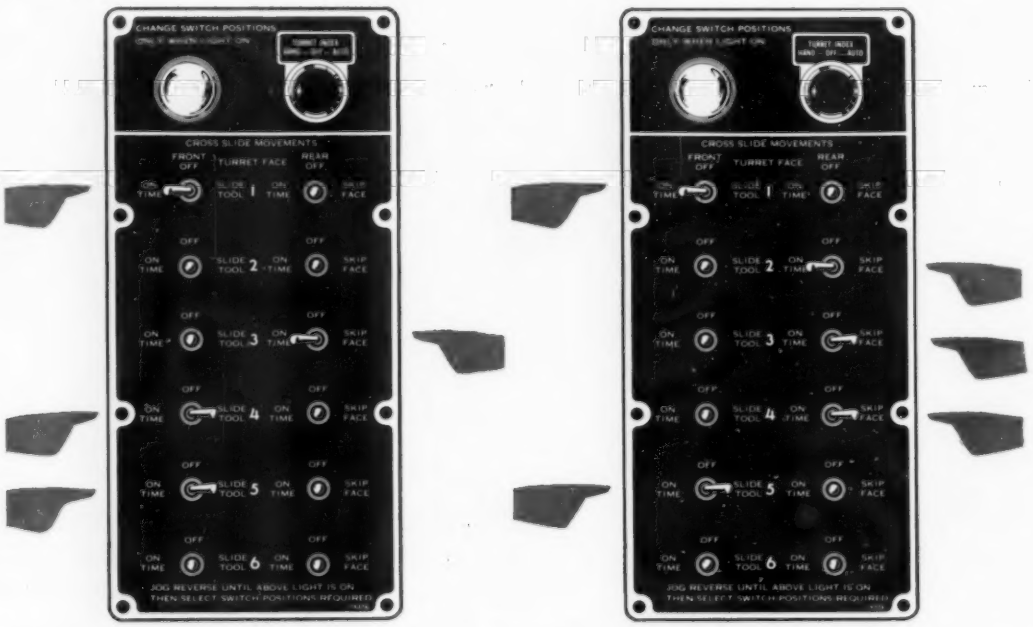

TURRET FACE No. 1—Front Cross Slide operates *on time* relative to the turret motion.
TURRET FACE No. 3—Rear Cross Slide operates *on time* relative to the turret motion.
TURRET FACE No. 4—Front Cross Slide is *delayed* relative to the turret motion, for slide tool operation.
TURRET FACE No. 5—Front Cross Slide is *delayed* relative to the turret motion, for slide tool operation.

TURRET FACE No. 1—Front Cross Slide operates *on time* relative to the turret motion.
TURRET FACE No. 2—Rear Cross Slide operates *on time* relative to the turret motion.
TURRET FACE No. 3—Skip turret face.
TURRET FACE No. 4—Skip turret face
TURRET FACE No. 5—Front Cross Slide is *delayed* relative to the turret motion, for slide tool operation.

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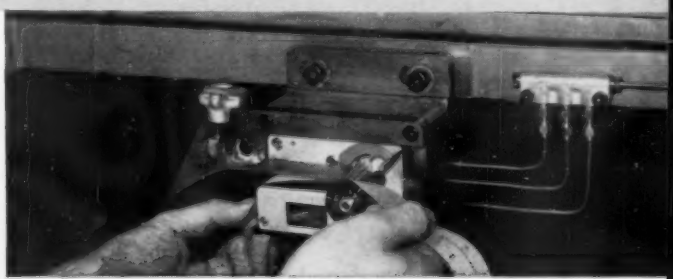
Simple in design, easy to understand and operate, and priced far below other systems, P&J Tape Control can save up to 25% in machining and setup time. Tape controls all movements of the spindle, turret and cross slides, including all speed and feed changes. Tape preparation for the average job takes less than 30 minutes and requires no technical knowledge. Programming setup time is eliminated by placing the tape in the machine's tape reader—which only takes a couple of minutes. Optimum programming is assured, with parts machined in minimum time.



3E-15 Automatic

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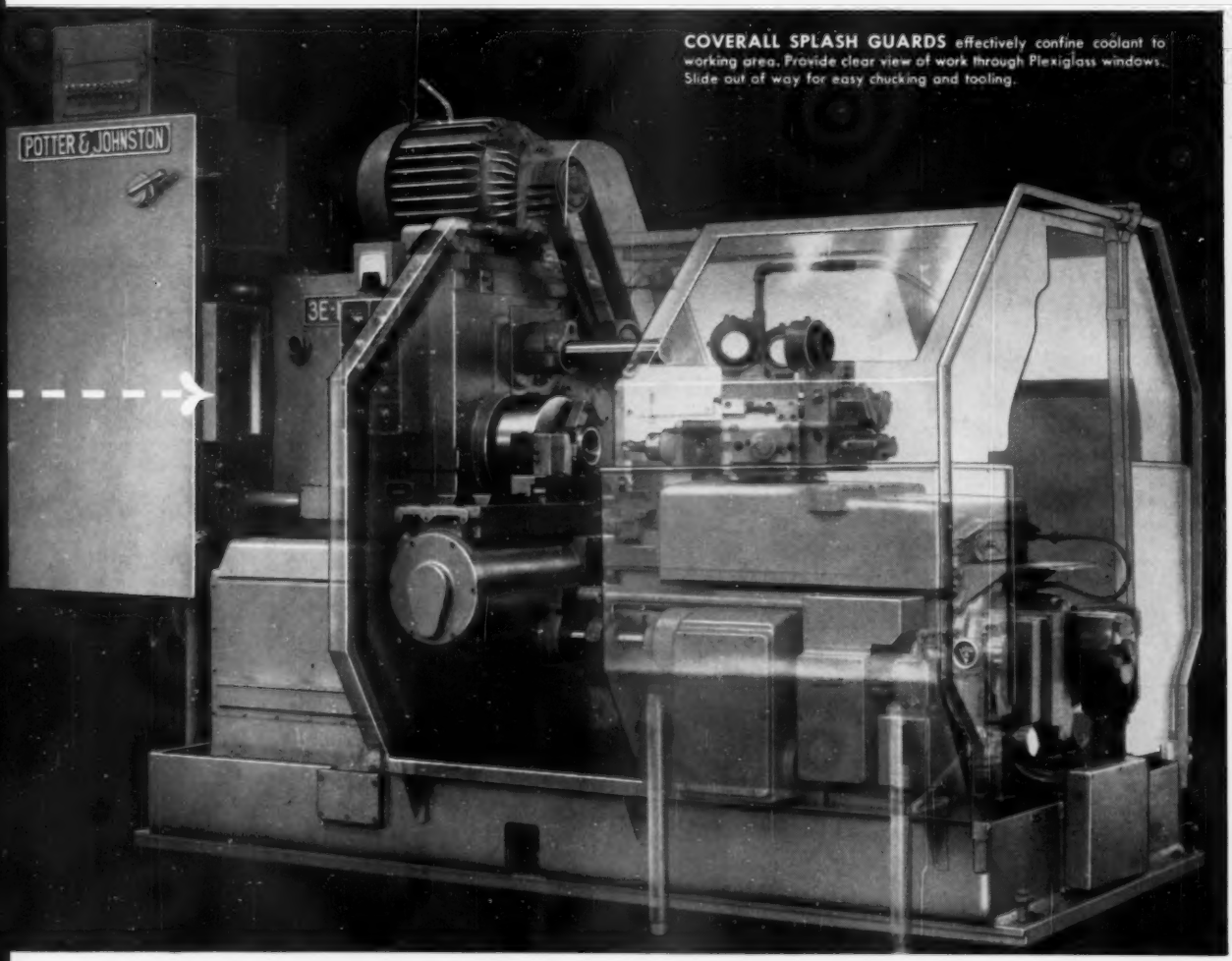

COVERALL SPLASH GUARDS effectively confine coolant to working area. Provide clear view of work through Plexiglass windows. Slide out of way for easy chucking and tooling.

The Potter & Johnston 3E-15 Automatic Turret Lathe is a truly new machine from the base up—*not* just an old model with a "face-lifting!" In addition to Selector Switch Cross Slide Control and Optional Tape Control, this machine also offers many other important new design and construction features, including: A new 15 hp headstock, with power to spare for fast metal removal with carbide tooling; greater rigidity throughout for faster roughing and more accurate finishing; "Control Zone" operation for faster, easier, more convenient setup and machining; separate drive for turret indexing for faster, easier setup; self-adjusting electric clutches that never require maintenance; a central, automatic lube system with single point fill; and a 6-face turret that allows more cuts per automatic machining cycle.

ON-THE-JOB PERFORMANCE . . . has already proved the ability of the P&J 3E-15 to cut machining time and costs. For a complete description of all the 3E-15 features, send now for your free copy of Circular No. 177 Pratt & Whitney Company, Inc., *16* Charter Oak Boulevard, West Hartford, Connecticut.

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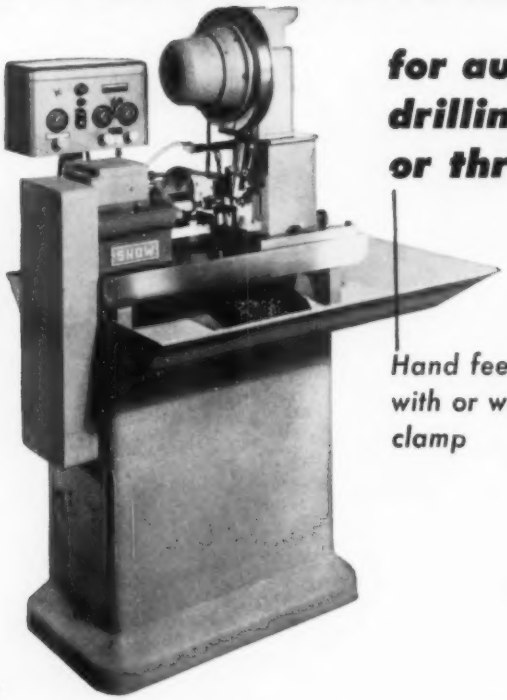

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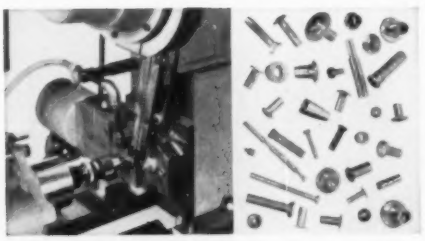
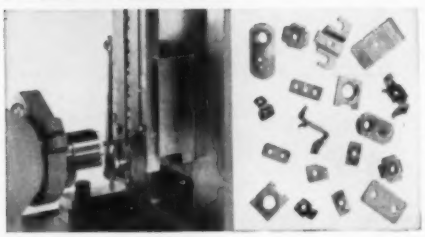


Drills 500-3600 per hour; hopper feed; air-operated clamping. Capacity #74 (.0225") to 3/16" in mild steel.



Taps 4000 per hour hand feed magazine. Capacity #0 to 1/4" fine pitch in mild steel.

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SNOW *master fixtures save dollars and days in tooling costs*

Tech Digests

Special Tests for Metals at Elevated Temperatures

Under certain conditions of design at room or somewhat higher temperature the permissible strain is of the order of magnitude of the elastic strain and it is necessary to compute design stresses on the basis of the elastic constants of the material. In most engineering work it is assumed that metals and alloys exhibit elastic behavior whereby the strain on loading is directly proportional to the stress and upon unloading the strain is completely recovered. By assuming that all polycrystalline metals and alloys are essentially isotropic, it is necessary to define only two elastic constants. Two of these are the proportionality constants between stress and strain in tension or compression and in simple shear. The elastic constant in tension or compression E is usually referred to as Young's modulus. The shear modulus G is usually referred to as the modulus of rigidity. A third constant, Poisson's ratio μ, is also required in many cases. However, it can be computed if both E and G are known. Poisson's ratio can also be measured directly from a simple tension test and is defined as the ratio of the transverse to the longitudinal strain. One important use of all three elastic constants is the computing of thermal stresses developed at elevated temperatures. Certain phenomena occurring in the solid state can also be studied from determinations of the elastic moduli.

Elastic-moduli measurement falls into two broad categories—testing under static-loading conditions and under dynamic-loading conditions. Under static loading, Young's modulus can be determined from a simple tension or a bend test and the shear modulus can be determined from a torsion test. In such tests fairly high-stress levels are reached. Under dynamic loading, low or high-frequency cyclic tests of relatively low-stress amplitude are generally used. Young's modulus and the shear modulus can be determined from such a test by measuring the natural frequency of a pendulum, the resonance frequency in oscillatory systems, or the velocity of longitudinal and transverse waves produced by high-frequency pulses.

Based on ASME Paper No. 59-A-112, "Survey of Various Special Tests Used to Determine Elastic, Plastic and Rupture Properties of Metals at Elevated Temperatures," by F. Garofalo, Edgar C. Bain Laboratory, U. S. Steel Corp. Complete paper available from American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

Engineering For Profit

The future belongs to those companies which plan and take steps to see that these plans are carried out. The growth companies of tomorrow in their respective industries are those which are developing their personnel along with the new products or major improvements in existing products. They are proceeding on a planned, consistent basis; they will not be panicked into snap decisions and erratic actions. They are developing employee attitudes, which insure receptivity to changes and willingness to plan and program the detailed steps of product research development, design, manufacturing and marketing. They are emphasizing the need for profits and for the reduction of costs. They know that costs must be controlled at their source; engineering designs is one of the key originating sources. Preventive steps pay off!

Based on ASME Paper No. 59-SA-41 by Herbert J. Richmond, A. T. Kearney and Co. Complete paper available from American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

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Sponsored Research—Good or Bad?

Research is an essential activity for any department of an engineering school. Without research, the department becomes stagnant and pedantic, to say nothing of getting behind the times. Research costs money. Therefore, funds must be obtained in order to conduct the research. Poor research should not be done and thus no funds must be supplied for it. Good research should be done and funds must be supplied for it regardless of source.

Based on a paper presented before Chemical Engineering Div., ASEE, by Ralph A. Morgen, Purdue Research Foundation. Complete paper available from American Society for Engineering Education, University of Illinois, Urbana, Ill.

Optimum Joint Design for High-Temperature Honeycomb Panels

Recent work in optimization of the sandwich itself has established rough guides for application of the brazed cellular structure, but questions inevitably arise as to the manner in which efficient panels are to be joined together without sacrificing a large measure of their efficiency.

There are two basic approaches to design of joints: the pictorial design approach, used extensively, and the analytic design approach, used less because of lack of time. The pictorial design procedure is mainly concerned with optimizing one type of structure such as honeycomb sandwich. Analytic design differs in that optimization is primarily interpreted as achieving the best load transfer at the lightest weight, irrespective of the type of structure necessary to accomplish the transfer. Regardless of which is taken, one point emerges that deserves emphasis—producibility is the major governing factor influencing the final selection.

Joint optimization, then, covers the compromise of the ideal joint with the most easily producible joint. The design engineer must immediately recognize that his skills are currently at the mercy of the production engineer who must reduce the design to the producible article at a reasonable cost. Many development programs are under way to extend the limitations of today's manufacturing skills. Surprisingly, the major problems encountered in this field of brazed sandwich joining have been in the allied area of welding. This turn of events is responsible for a temporary regression to less desirable brazed joints by designers whenever possible.

Based on SAE Paper No. 99-U by F. J. Filippi and B. Levenetz, Solar Aircraft Co. Complete paper available from Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

ASTM Views on Engineering Education

Basic considerations include an appreciation that the person being educated is at least as important as the educational process to which he is to be subjected. It is necessary, therefore, that any over-all scheme of education be adaptable to the abilities and the interests of each student. These abilities and interests will encompass a broad spectrum from a prime interest in almost pure science at one end to a complete preoccupation with the practical aspects of engineering at the other. More or less in parallel with this is the concept that engineering education itself must cover a similar spectrum extending from the fundamental sciences at one end to practical training at the other.

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The reference to spectra here is a deliberate attempt to emphasize that there is a gradual shading from one aspect to another rather than a series of steps. If well defined steps or boundaries existed, it would be much easier to plan educational programs to suit sharply defined interests and needs.

It seems likely that in the near future the number of young men and women who may be in line for education beyond the high school level will be much larger than can be accommodated satisfactorily by the facilities for such education or training that are likely to be available. The obvious solution to this problem is to become more selective and demanding in the qualifications for admission to the engineering colleges of universities and technical institutes. The percentage of freshmen in engineering courses who fail to graduate is already much too large. While this suggests a need for improvement in the educational processes, it also suggests at least as strongly that we cannot afford to waste limited facilities for engineering education on unqualified or poorly prepared students. It is certain that schools for engineering education can have no place in implementing the probably mistaken idea that every high school graduate will necessarily benefit from a college education. The setting of advanced standards for admission to engineering schools will discourage the unqualified. It will probably serve also to get them more promptly into a proper and rewarding field of some other useful activity. This will have the advantage of avoiding the frustration of those whose failure before graduation is inevitable, while leaving room for those so endowed mentally and properly trained as to give them an excellent chance of final graduation.

Proper training for college is probably the most vital component of engineering education. In recent years it seems to have suffered from that aspect of mass education that tailors the educational process to suit the average, and sometimes the below average, student. This process should be charged so as to permit the more gifted students, and especially those heading for engineering education, to advance at a rate and in directions more in keeping with their real abilities and needs. By such means, the time required for further education, especially in the basic sciences and mathematics in the universities might be reduced. At the least, less time would be spent in the universities in preparing the students for the more advanced courses on which the universities should be able to concentrate.

Based on a talk contributed to Symposium on Education in Materials. Jointly sponsored by ASEE and ASTM, by F. L. LaQue, V. P., ASTM. Complete copies of the talk available from American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

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A Mass-Produced, All-Welded, High-Temperature Sandwich

Steel sandwich is desirable in many applications where lightweight, high-strength and resistance to high temperature are important factors. Logically, the aircraft and missile industry has been concerned with development of these processes. One of the chief objections to the use of sandwich has been its high cost—slow production processes are, of course, the chief factor in this cost. It was the objective of the program conducted by the Missile Division of North American Aviation, Inc. to develop techniques for mass producing a quality sandwich.

Spacemetal sandwich is produced by patented processes which makes an all-welded, steel sandwich with a corrugated core and two facing sheets.

The core is formed from 0.002-inch type 301 stainless steel, ½ hard and the sides of the corrugations are beaded for additional flatwise compressive strength and increased shear modulus.

There is a deviation from a pure truss in that a flat surface has been provided at the core crests to allow for the electrode to make the spotweld to the face sheet. The facing sheets are 0.006-inch, type 301, stainless steel, full hard temper. The core height and pitch are $\frac{5}{32}$ inch and the overall sandwich height is approximately $1\frac{1}{64}$ inch.

Costs of Spacemetal structures are favorable when compared with conventional material construction and provide large savings when compared with customized fabrication. For comparison with conventional construction, factors which appear favorable include larger panel areas, fewer frames, and stiffeners, less local stringers, and less welding, riveting, fit-up, etc. As an example of these specific advantages, a cowl access door which was studied showed a weight reduction from 75 pounds to 40 pounds, or a 35 pound savings, when Spacemetal rather than conventional material was used. Manufacturing cost estimates were reduced to 60 percent of the original. A prototype Spacemetal sandwich door compared to the original construction graphically illustrates the difference.

In another case, a typical missile structure indicated a 27 percent weight reduction from an original gross weight of 2200 pounds. In yet another specific case, a 40 pound saving in airborne weight was effected in redesign of shells and fins of an air-launched missile.

Based on SAE Paper No. 99V by J. W. Scheuch, North American Aviation, Inc. Complete paper available from Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

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The Machining of Ultrastrength Alloys

Many ultra-strength alloys are new to the industry and only meager machining information is available for use in setting up production machining operations. For the more familiar materials such as the martensitic low-alloy steels, hot-work die steels and martensitic stainless steels, there is a lack of data for machining these materials in the high-hardness ranges. Hence, a trial and error method must be used in the production operations which involves considerable time and expense. The loss of time due to development of the production machining process can seriously disrupt planned schedules for new airframes and engines. Because schedules must be adhered to, production manufacturing departments are limited as far as process development is con-

cerned. As a result, manufacturing of the components is done by any available method. The manufacturing process, in many cases, loses the identity of a production operation and becomes a toolroom operation. The need for machinability information to be used as an aid in setting up production processing on the high-strength thermal-resistant alloys becomes evident.

In view of the difficulties being encountered in machining these alloys, the Air Force has set up a machinability research program to evaluate the machining characteristics of the more commonly used high-strength thermal-resistant materials.

Based on SAE Paper No. 43R by J. Maranchik, Jr., J. V. Gould and P. R. Arat, Metcut Research Associates Inc. Complete paper available from Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

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Forming and Fabrication of Yttrium Metal

Development work in forming and fabricating yttrium, a rare metal, by General Electric at the Aircraft Nuclear Propulsion Dept., has substantially advanced its usefulness. A breakthrough in processing techniques for yttrium fluride has produced a metal of greatly improved purity. Yttrium holds promise in the atomic power field because of its strength, moderate absorption capacity for neutrons, and its benefits when added to steel alloys. Work in improving the metal was touched off in part by inability to successfully cold roll it. However, it was found that small alloying additions of chromium, aluminum and vanadium increased the cold workability of yttrium.

The following experience is reported in working with yttrium:

1. It is hazardous to machine because of its tendency to burst into flame. For this reason, chips must be kept large and separated
2. In lathe work, dry cutting rather than use of lubricants is preferred. Tool steel or carbide tools may be used
3. Milling operations, when lubricant is used, require use of high-flash point oil. Work temperature should be kept below 140 F. Dry cutting is preferred
4. Depending on the job, high-speed tool steel or carbide-tipped drills can be used
5. For grinding yttrium, either a water-soluble oil or a high-flash point oil should be used.
6. Casting of useful shapes is restricted to vacuum melting

7. Successful forging practice of yttrium metal has been limited to hot working with specific conditions dependent on the purity of the material
8. Hot swaging has been successfully carried out in the temperature range of 1400 to 1500 F. Cold swaging, while more successful than rolling, often results in severe cracking and splitting of the rod
9. Hot extrusion has proved the most successful method of breaking down cast ingots
10. Little work has been done in the areas of wire drawing, capping and spinning
11. Annealing has been carried out at ANPD, with the most efficient annealing treatment between 2200 F for one hour, or 1800 F for three hours
12. Yttrium was found to be susceptible to cracking when welded, although less cracking occurred when filler metal was added during welding.

Based on a paper presented to ASM Atomic Energy Commission Symposium, by J. M. Williams and C. L. Huffine, General Electric Co. Complete paper available from American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

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Limit Switches versus Proximity Switches on Machine Tools

As machine tools become increasingly automatic and complex, contact-making sensing devices such as limit switches and proximity switches are used in ever greater numbers. Since today's machines are quite expensive, and excessive downtime cannot be tolerated, requirements for the sensing devices are increasingly difficult to meet. The importance of obtaining better sensing devices is borne out by a number of recent surveys which show that faulty input devices, and primarily sensing devices, are one of the major causes of machine downtime.

Limit switches represent the majority of sensing elements, but proximity switches are now being used in more and more applications. Limit switches have been used on machine tools for many years, and like many other control devices, have shown tremendous improvement over the original switches used. Although proximity switches are relatively new, and have not been completely proven, they are playing an increasingly important part in machine tool control, as well as in many other types of automatic control.

As often the case, there is a great deal of argument concerning the relative merits of these two devices. The attitude of many engineers who insist that heavy-duty limit switches are the only suitable devices to use is somewhat unreasonable, but probably no more so than the attitude of other engineers who insist that proximity switches should be used for all applications.

Actually, of course, limit switches and proximity switches both have their advantages and disadvantages. When properly used and applied, both do an outstanding job with a high degree of reliability. Machine tool engineers need to give careful consideration to the relative merits of both devices, including economic factors, and use the type best suited for the particular application.

Based on Paper A-5919 presented at the 23rd Annual Machine Tool Electrification Forum, sponsored by the Westinghouse Electric Corp., by John M. Morgan, Jr., Cincinnati Milling Machine Co. Copy of the complete paper available from Westinghouse Electric Corp., Box 2278, Pittsburgh, Pa.

Evaluation of Ablation Materials for High-Temperature Application

Structural materials for high-temperature environments can be classified in three general areas: (1) Insulating Materials—which prevent transmission of heat, do not melt or vaporize, and maintain their structural integrity, (2) Heat Sink Materials—which absorb and conduct heat at a rapid enough rate so as to maintain a temperature below critical, and (3) Ablation Materials—which absorb a relatively large amount of heat so as to decompose, liquify, and/or vaporize as a surface phenomenon, while the interior of the material maintains a subcritical temperature and consequent structural integrity.

Actually, ablation is a mass-transfer process involving a coolant action at high temperatures. Another mass-transfer process, transpiration cooling, involves a foreign material mechanically forced to the surface, where in the vapor form, it acts as a coolant. Ablation is much more complex, involving either sublimation or combined melting and vaporization, as well as decomposition, combustion, and chemical reaction between components in the boundary layer.

Based on SAE Paper No. 98T by M. A. Schwartz, W. Bandaruk and G. J. Mills, Aeronutronic Div., Ford Motor Co. Complete paper available from Society of Automotive Engineers, 485 Lexington Ave., New York 17, N. Y.

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Steel—By Slipstick or By Slapstick

I would like to suggest that the engineer ask himself the following questions when he is designing an automotive part:

1. What is the magnitude of the stress part will be required to withstand in service?
2. Will the stress be fluctuating over a wide range and at what speed?
3. Will a heat treatment be required, and is the part designed so that it can be heat treated in a practical manner? Will stress risers be present which will make heat treating impractical if not impossible?
4. Will welding be required?
5. How will the part be formed? Is the hardness requirement such that it can be heat treated before machining to minimize distortion? Is forging or casting a consideration?

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6. Would the safety of the vehicle and occupants be jeopardized if the part fails?
7. Will corrosion be a problem and should a protective coating be specified. What are the service conditions related to corrosion?
8. Will service be such that favorable residual stresses will increase the life of the part? Should shot peening be considered?

Listed here are but a few of the many questions that the engineer should ask himself, but there are many others and they lead to this one reminder: the material specification for a part is a critical phase of design. If any doubt exists, consult your metallurgist before releasing a component to drafting.

Based on SAE Paper No. 73T by Robert E. Harvie, Chevrolet Motor Div. Complete paper available from Society of Automotive Engineers, 485 Lexington Ave., New York 17, N. Y.

What's Wrong with Machine Tool Components

There is an urgent need for the vendors of control components to look at the size and complexity of today's machine tool control circuitry. In the past, machines were controlled by a motor, a starter and two push buttons. Today some machines utilize hundreds of relays, dozens of motors and starters and a very great number of various other electrical and electronic components. The trend toward numerical control of slide or tool positioning has evolved in the past few years from a laboratory toy to a competitive product. The controls that make this type of "automation" a reality are becoming increasingly complex and, unfortunately, larger and larger. More seriously, this increased number of components has reduced the over-all reliability of the system.

Based on Paper A-5920 presented at the 23rd Annual Machine Tool Electrification Forum, sponsored by the Westinghouse Electric Corp., by M. H. Sluis, Pratt & Whitney, Inc. Copy of the complete paper available from Westinghouse Electric Corp., Box 2278, Pittsburgh, Pa.

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Structural Foil for Hot Parts

When designing structures for elevated temperatures, it is usually necessary to use high-density materials. In most cases, weight is a problem and designers must keep the gage of these materials to a minimum. As a result, more and more structures are being designed from very thin sheet.

The most common thin-sheet construction now in use is the sandwich structure, usually made with foil gage stabilizing cores oriented normal to and brazed to the surface skins. A less common but occasionally used core is the corrugation type with corrugations spotwelded parallel to the skins. Ryan has developed a third type of structure, "MiniWate," which combines high strength with light weight in a homogenous, heat-resistant unit.

"MiniWate" consists of a single skin, resistance spotwelded to a sheet of miniature corrugations. This type of construction eliminates blind attachments, thus simplifying both manufacture and inspection. The spotwelding technique also eliminates the added weight of an adhesive or brazing alloy.

Based on SAE Paper No. 99T, by M. J. Breitenbach and B. Lake, Ryan Aeronautical Co. Complete paper available from Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

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Automatic Gaging and Sorting of Transistor Base Material

A dice gage automatically gages, classifies and sorts germanium and silicon wafers on the basis of thickness. The equipment handles over three thousand wafers per hour, gaging each wafer to an accuracy of ± 10 millionths of an inch and sorting the wafers into thirteen classifications of thickness. The normal width of some of these classifications is less than 50 millionths.

The major difficulties in automating this gaging and sorting process were caused by the miniature size and fragile nature of the waters. Typically, a wafer may be 40 thousandths of an inch square and one-and-one-half thousandths of an inch thick.

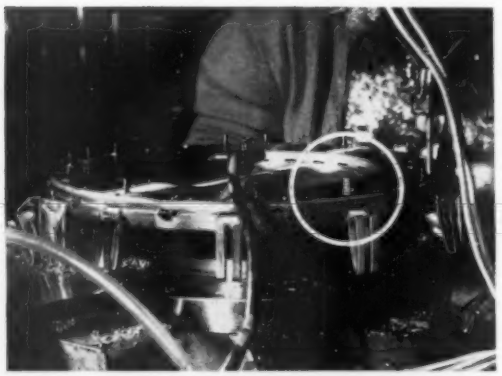
Automatic techniques were developed for feeding, positioning, gaging and sorting these wafers. Special developments for the equipment have included rotary and linear feeding devices, methods of removing doubles or "piggyback" pairs of wafers, photocell part recognition circuits, single-die strippers, transfer masks, gaging anvils and disposal chutes.

Based on a paper presented at the 14th Annual Conference of the ISA, by J. P. Philbin and W. B. Finnegan, Airborne Instruments Laboratory Div., Cutler-Hammer Inc. Complete paper available from Instrument Society of America, 313 Sixth Ave., Pittsburgh 22, Pa.

Practical Tooling Tips

No. 3 of a series

Are your tool makers wasting time making complicated tooling gadgets when a standard, off-the-shelf Vlier part could do the job much better? Why not examine your present drawings and see where these simple, low-cost parts can be used. You will be amazed at the savings possible.



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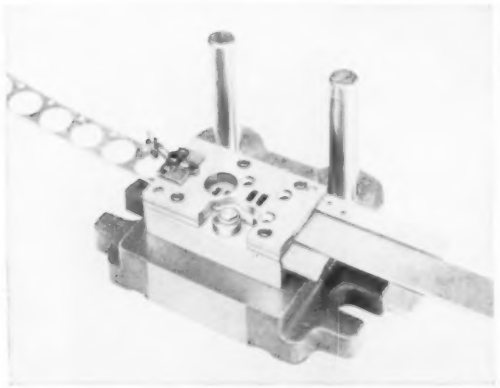

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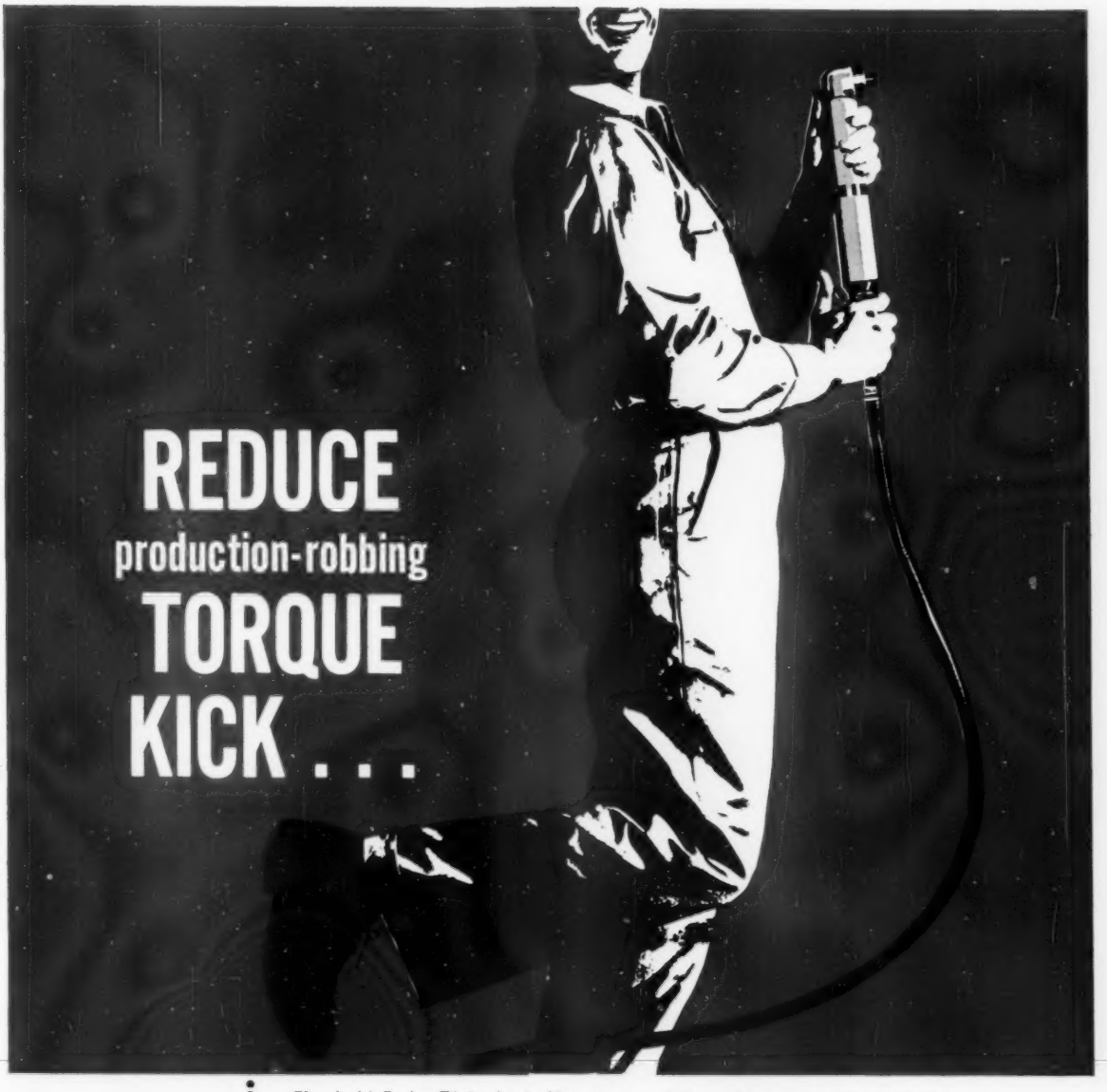

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QUICK COMPARISON CHART

Some unique combinations of electrical and physical properties in Anaconda metals that may save you money—handle tough jobs better

Properties shown for precipitation-hardened condition—Heat-treatable alloys	ELECTRICAL CONDUCTIVITY % IACS	TENSILE STRENGTH psi	YIELD STRENGTH at 50% ext. under load, psi	ELONGATION % in 2 in. or 4xD	MACHINABILITY compared with F.C. Brass at 100	FORMS AVAILABLE
Chromium Copper-999 (Cu 99.05%, Cr .85%, Si .10%)	75	65,000	55,000	20	20	Rod Wire Tube Forgings Strip
Leaded Nickel Copper-831 (Cu 97.8%, Pb 1.0%, Ni 1.0%, P .2%)	55	80,000	70,000	7	80	Rod
Cunisil-837 (Cu 97.5%, Ni 1.9% Si .6%)	30 to 42	90,000	70,000	8	40	Rod

To give you a basis of comparison, here are properties of two standard Anaconda electrical coppers

ETP Copper—100 (Cu 99.9+%)	100	48,000	40,000	15	20	All mill forms
Leaded Copper—126 (Cu 99.0%, Pb 1.0%)	98	48,000	40,000	12	80	Rod bar

The values given above are intended as a guide to some unusual combinations of electrical and physical properties available among Anaconda alloys. If any of them gives you an idea for possible solution to a tough problem or indicates a way to cut costs without sacrificing quality or performance — see your American Brass representative for more details. Or send in this coupon today.

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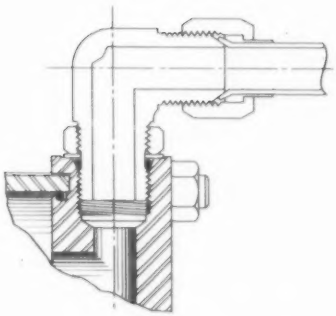

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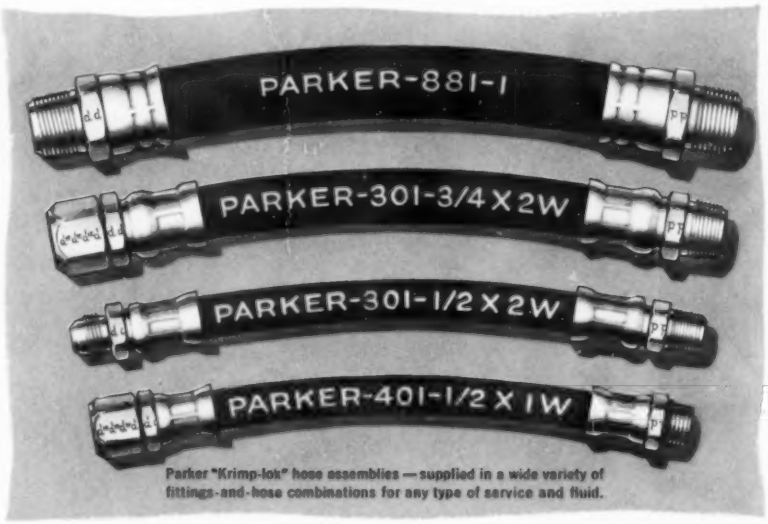

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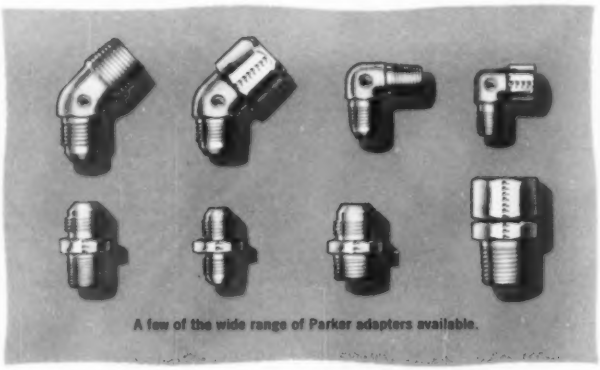

A few of the wide range of Parker adapters available.

You may require permanent-end hose assemblies for your production AND re-usable fittings with coils of hose for quick, trouble-proof replacements in the field. With the addition of Parker's new "Krimp-lok" fittings, permanent-end assemblies are now available from Parker. They use the same Parker hoses that enjoy a wide acceptance when used with Parker *no-skive* "Hoze-lok" fittings in the replacement field.

A full range of Parker adapters is also available.

Ask your Parker Hose Distributor, listed in the Yellow Pages, for engineering advice and literature on "Hoze-lok" re-usable fittings, also Parker hose and adapters. Write us in Cleveland regarding your requirements for Parker "Krimp-lok" Hose Assemblies.

Parker

FITTINGS AND HOSE DIVISION

17325 Euclid Avenue

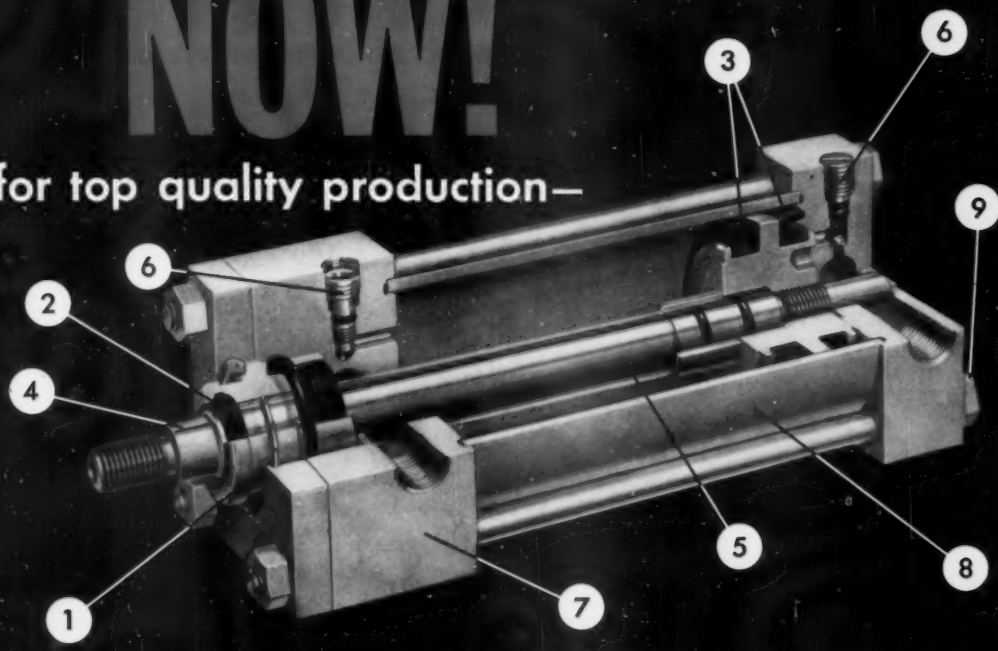
Cleveland 12, Ohio

Parker "Hoze-lok" no-skive hose fittings and Parker hose, the ideal combination for short-run production and quick, reliable field replacement.

A DIVISION OF PARKER-HANNIFIN CORPORATION

NOW!

for top quality production—



1. Bronze Bearing, with self-adjusting "U" Cup Piston Rod Seal for longer wear.
2. Rod Wiper protects Piston Rod Seal and keeps Cylinder clean.
3. "U" Cup Seals expand with pressure to provide positive seal with minimum friction.
4. Wrench Flats make for easy installation.
5. Ground, hard chrome-plated Piston Rods have minimum yield strength of 125,000 psi.
6. Self-locking cushion adjusting screw and ball check are below surface for protection . . . easily accessible.
7. For extra strength, Cylinder Ends and Mounting Plates are machined from bar stock and steel forgings.
8. Cylinder is precision-finished brass for extra heavy duty.
9. Variety of mountings can be interchanged—easily match any installation requirement.
10. Interchangeable with all JIC Cylinders.

SCHRADER SQUARE-END CYLINDERS

meet and exceed JIC specs . . . 250 psi air . . . 750 psi hydraulic!

Here's compact, versatile straight-line power. Just look at the features!

Use Schrader's new square-end double-acting cylinders for holding, positioning, moving work—for push, pull or lifting—for automating manual operations. In five sizes up to 4-inch bore, and with five interchangeable mountings, these "square-ends" are economical and versatile. Bolt, leg, flush, side flush or base . . . each JIC Cylinder will mount all five ways. Suitable for air pressures to 250 psi, or hydraulically to 750 psi—available cushioned or non-cushioned.

You get safe, controlled, low-cost power with Schrader "square-ends"—another addition to the line of famous Schrader quality Air Control Products.

Large stocks available at nearby Schrader Distributor—plus expert help to improve your air control circuits. Write for your complete specifications and data on these "square-ends."

Bolt Mounting **Leg Mounting** **Flush Mounting** **Side-Flush Mounting** **Base Mounting**

Schrader
a division of SCOVILL

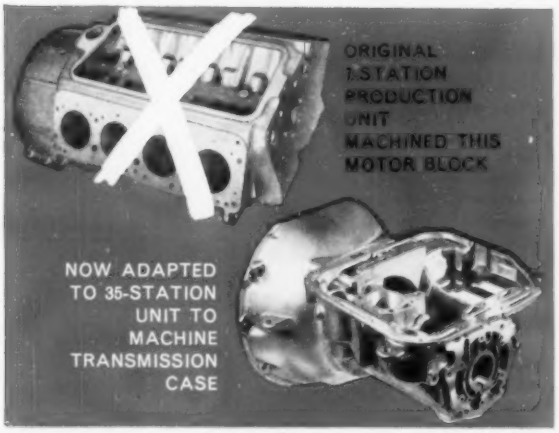
A. SCHRADER'S SON
Division of Scovill Manufacturing Co.
462 Vanderbilt Avenue, Brooklyn 38, N. Y.

QUALITY AIR CONTROL PRODUCTS

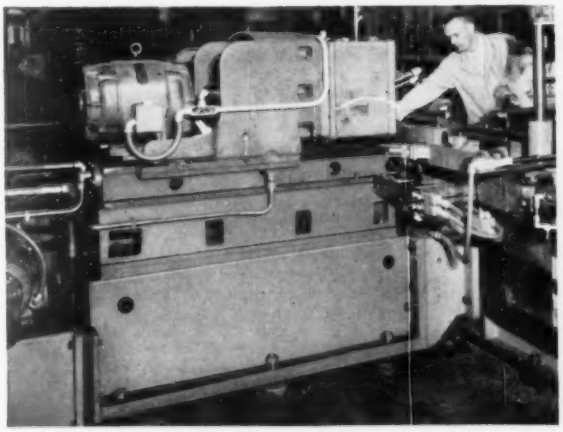
USE READER SERVICE CARD, CIRCLE 119

USE READER SERVICE CARD, CIRCLE 120

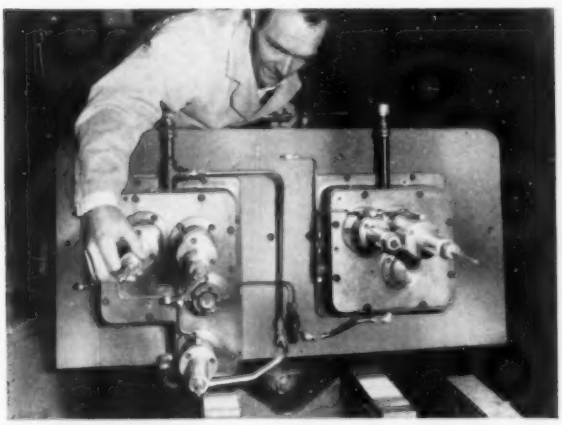
HOW BARNESDRIL PRODUCTION UNITS SAVE MONEY THROUGH FLEXIBILITY!



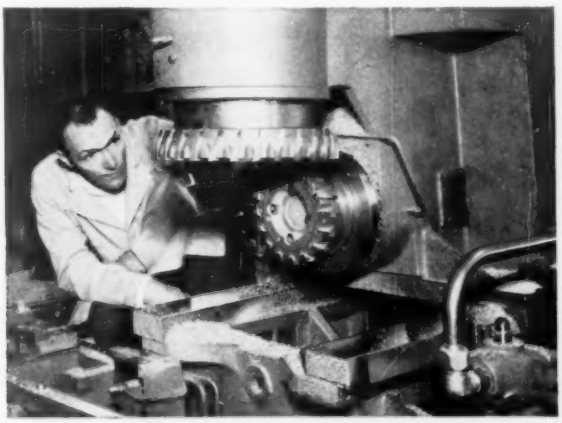
BarnesdriL units regroup easily . . . economically. A leading automobile manufacturer, for instance, is reducing the costs of tooling for a new transmission case by using BarnesdriL units from an obsolete motor block line built to the "Building Block" principle. "Before and after" parts are illustrated.



This "obsolete" unit will go right on producing! That's because BarnesdriL unit and slide assemblies are separate. Base and column sections are separate, too, for widest possible flexibility. Units have inserted hardened and ground steel ways, with saddle type construction to reduce height of auxiliary heads.



By simply replacing the "pot" this unit can be adapted to major styling changes. All "pot type" heads are used on this line. Pallets used to hold the work fixtures also can be re-used when the machine is rebuilt. Since pallets rise very little from the rest pad for indexing, they automatically sweep chips into the flume.



This duplex milling head is combined with drilling, tapping, reaming, boring, and facing units on the new 35 station machine. Gross production rate is one case every 36 seconds. For easy maintenance, hydraulic cylinders on BarnesdriL units can be removed by loosening 4 bolts and uncoupling the tie rod.

Get the complete story in cost-cutting BarnesdriL Production Units . . . write for catalog 150-D Today!

BARNESDRIL PRODUCTION UNITS

Honing Machines / Production Units / Filtration Units / Drilling Machines

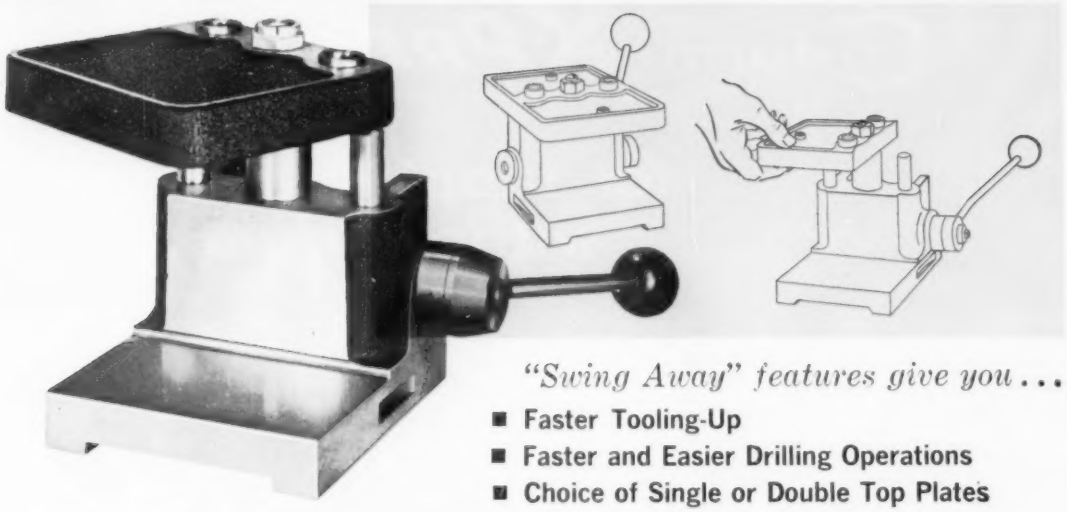
BARNES DRILL CO.

870 Chestnut Street • Rockford, Illinois

DETROIT OFFICE — 13121 Puritan Avenue

tool quickly for long or short runs!

ABC LIFT SWING DRILLING FIXTURES

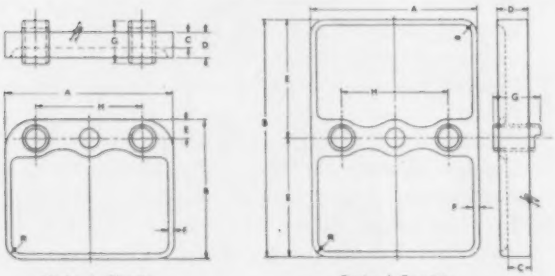


"Swing Away" features give you . . .

- **Faster Tooling-Up**
- **Faster and Easier Drilling Operations**
- **Choice of Single or Double Top Plates**

INTERCHANGEABLE TOP PLATE ENGINEERING DATA

Top Plate Dimensions



Style 1 Single — Style 4 Double

Top Plate Sizes

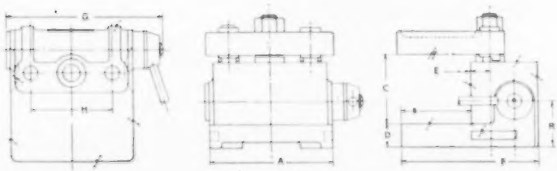
Top Plate Style	Top Plate Number	A	B	C	D	E	F	G	H	R
1	2201	2⅛	2⅛	½	½	7/16	—	¾	1½	5/16
4	2204	2⅛	3⅛	½	½	1 1/16	—	¾	1½	5/16
1	3201	3⅛	3 7/16	½	½	⅝	—	1	2½	⅜
4	3204	3⅛	5⅛	½	½	2 13/16	—	1	2½	⅜
1	4201	4¼	3¼	½	¾	⅝	3/16	1	2½	½
4	4204	4¼	6¼	½	¾	3⅛	3/16	1	2½	½
1	5301	5½	5	¾	1	⅝	3/16	1⅜	3½	⅝
4	5304	5½	8¼	¾	1	4⅛	3/16	1⅜	3½	⅝

Larger sizes and other style single top plates available.

IMPORTANT: When ordering Complete Assembled Lift Swings, specify first 3 digits of Base Number and 1 or 4 to indicate the style of Top Plate desired. EXAMPLE: LS-3221 = 3220 Base with 3201 (Style 1) Top Plate.

FIXTURE BASE ENGINEERING DATA

Fixture Base Dimensions



Top View (Top Plate Removed) — Front View — Side View

Fixture Base Sizes

Lift Swing Base Number	A	B	C	C Shut suggested max. clamp	C Open	D	E	F	G	H	R
2220	2⅛	1⅛	1½	1¾	2¼	1	½	3⅛	3¼	1½	1 3/16
3220	3⅛	2⅛	2	2⅛	3	1	⅛	4½	5	2½	1 1/16
4220	4⅛	2⅛	2½	2⅛	3½	1	⅛	5	5¼	2½	1¼
5330	5⅛	3⅛	3	3⅛	4⅛	1	1	6¼	6¼	3½	2
5340	5⅛	3⅛	4	4¼	5⅛	1	1	6¼	6¼	3½	2
5350	5⅛	3⅛	5	5¼	6⅛	1	1	6¼	6¼	3½	2

Larger sizes available. For tooling suggestions and complete engineering data write for Catalog LS-58.

ACCURATE BUSHING COMPANY

443 NORTH AVE., GARWOOD, N. J.

Announcing

HY-PRO

Co-form® X-PRESS® TAPS

Manufactured under license from Besly-Welles Corporation

for tapping threads without cutting

Recommended for tapping . . .

Copper Brass Lead
Aluminum Zinc
Steel Magnesium
Die Castings
Leaded Steel
Stainless Steel
— other ductile metals

Tapping operation is the same

Conventional methods and equipment are used, except for change to larger tap drill sizes.

NOW — from HY-PRO you can get the newest in tap design — Co-form X-PRESS fluteless taps that are setting cost-reduction records on many jobs that were formerly "tap-killers".

HY-PRO Co-form X-PRESS taps cold-form threads in through or blind holes, with these advantages . . .

No Chips to clog and cause tap breakage — no chip removal problems • **Permit Faster Tapping Speed** and boost production from automatic equipment **Provide Accurate Control** of hole size — cannot be forced into lead error • **Eliminate Blind Hole Tapping Problems** — no chips to jam at bottom • **Form Stronger Threads** with better holding power • **Taps Are Stronger** without flutes, especially in smaller sizes **Taps Last Longer** and maintain accurate size tolerance **More Holes Per Tap** — up to 40 times greater tap life.

Try HY-PRO Co-form X-PRESS taps on your toughest tapping operations. For complete application information, call your HY-PRO Distributor or write: HY-PRO Tool Company, Dept. C, New Bedford, Mass.

Tap for less with Co-form® X-PRESS®

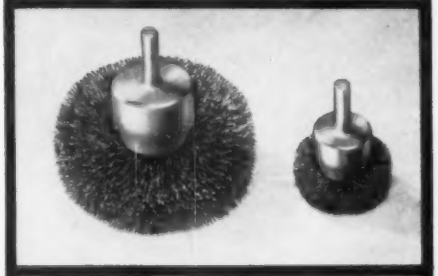
For the complete line of HY-PRO standard taps from stock, call your local HY-PRO Distributor.

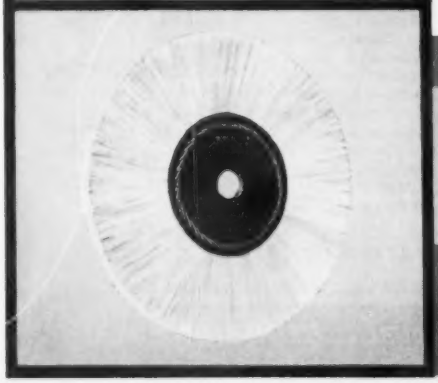
® Co-form is a registered trademark of Hy-Pro Tool Company.

® X-PRESS is a registered trademark of Besly-Welles Corporation.

HY-PRO

HY-PRO TOOL COMPANY
NEW BEDFORD, MASS., U. S. A.





$250.00 CASH FOR YOU

DISCOVER AMERICA'S MOST VERSATILE TOOL— AND WIN A CASH AWARD!

For the 12 Best Wire Brush Applications of the Month the Anderson Corp. will award:

1st prize	**$100.00**
2nd prize	**50.00**
10 3rd prizes	**10.00 ea.**

Write on your company letterhead describing any unusual or effective uses of wire brushes in your plant, and you will be eligible for one of the 12 cash awards. Letters must be postmarked not later than January 31, 1960, and all will become the property of the Anderson Corp. Winners will be notified by Western Union on February 20, 1960. Lists of winners will be provided upon receipt of stamped, self-addressed envelope after that date.

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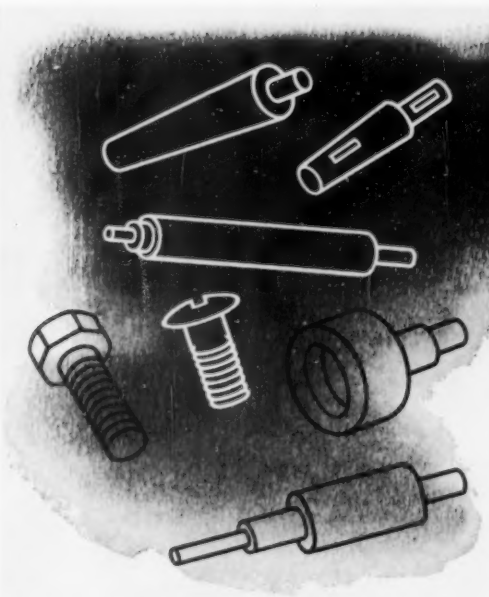
Anderson



Machine it! Put it to work!

Prehardened

VISCOUNT 44

High Strength Steel

No Further Heat Treatment Necessary!

Here's the high strength steel that cuts engineering and maintenance problems to the bone on maintenance and machine tool applications. Unexcelled strength, good toughness and increased wear resistance—these are the advantages of VISCOUNT 44, even when exposed to temperatures up to 1000°F.

More important, risk of size change and distortion of critically-engineered parts during heat treatment is completely eliminated. VISCOUNT 44 is furnished prehardened at Rockwell C 42-46 . . . it's practical to machine . . . easy to work!

NOMINAL ANALYSIS

Carbon	.40	Chromium	5.00
Silicon	1.00	Molybdenum	1.20
Manganese	.75	Vanadium	1.00

plus Alloy Sulphides

MECHANICAL PROPERTIES

Furnished Hardness	RC 42-46
Tensile Strength	180,000-220,000 psi
Yield Strength (0.2% offset)	160,000-200,000 psi
Reduction of Area	40-50%
Elongation, 2"	10-15%
Coefficient of Expansion 80-1000°F	7.0 x 10^{-6} inches/inch°F

Have a high strength steel problem? Call a Latrobe sales engineer today! Or, send for VISCOUNT 44 literature.

TYPICAL APPLICATIONS

Spindles • Shafts • Brake Dies • Forming Rolls • Tie Rods
Arbors • Axles • Bolts • Structurals • Cams

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LATROBE, PENNSYLVANIA

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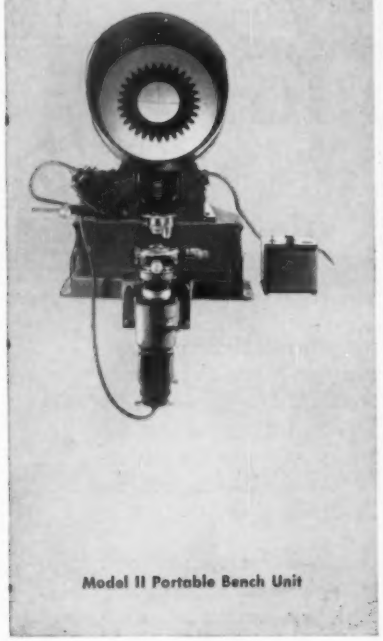
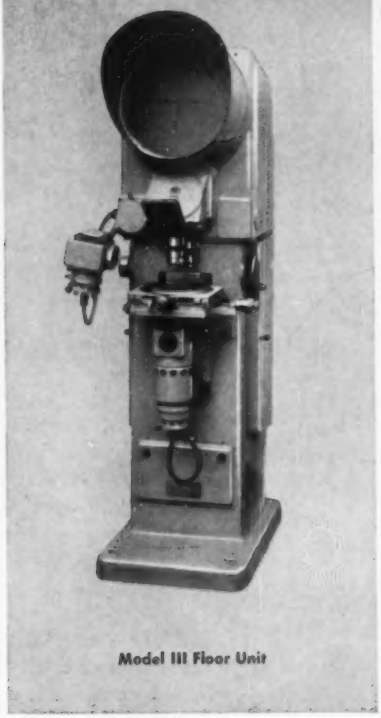
NIKON OPTICAL COMPARATORS



Model II Portable Bench Unit



Model III Floor Unit

Model VI Bench Unit

3 models for accurate inspection of precision parts

Whatever your inspection needs – whatever your budget considerations – there's a Nikon Optical Comparator to meet the demands of both. For Nikon has successfully fulfilled the two most pressing requirements in industry – *outstanding performance at moderate cost.*

Whichever of these three models you select, you will discover the same demonstrable qualities in each: bright screen illumination, sharp edge-to-edge definition, ease and speed of operation, and an almost unlimited versatility. You will be especially impressed with the high accuracy of performance, the simplicity of mechanical design, and the ruggedness of construction.

Nikon comparators may be used for surface as well as contour inspections – simultaneously, if desired. The inherent versatility of the Nikon is even further extended by the availability of a wide assortment of accessories for general and special applications: lenses covering a wide range of magnifications – 8 different stages – goniometers – fixtures – charts – vernier protractor screens – and photo-recording equipment.

NIKON Model II Portable Bench Unit –

Ready portability is one of its major advantages. It can be easily carried from one part of the plant to another for accurate on-the-spot inspections and measurements – with minimum loss of down time. Equipped with 3-lens turret.

NIKON Model VI Bench Unit –

Offers many advanced features: hand-wheel control for fine focusing, built-in illuminator for surface inspection, built-in blower system, bayonet mount for rapid lens interchangeability. Also available with bayonet, 3-lens turret.

NIKON Model III Floor Unit –

A rugged unit of extreme efficiency and accuracy – completely self-contained in cast aluminum housing. Fine movement focusing system employs lead-screw drive with scraped ways and adjustable gibs. Equipped with 3-lens turret.

For illustrated catalog, complete specifications and prices of all units and accessories, write to: Dept. TE-1.

NIPPON KOGAKU TOKYO **NIKON INCORPORATED** • 111 Fifth Avenue, New York 3, N. Y.

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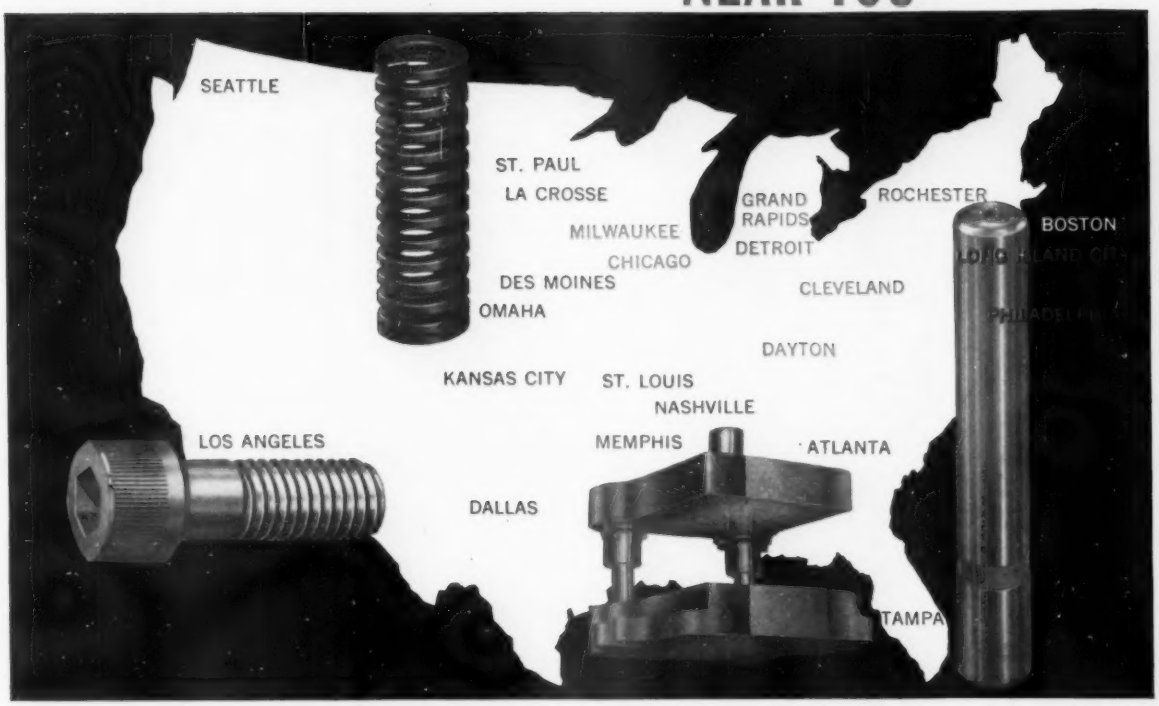

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Chandler & Farquhar Company
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MICHIGAN, Detroit 16
Danly Machine Specialties, Inc.
1549 Temple Avenue

MICHIGAN, Grand Rapids
Danly Machine Specialties, Inc.
113 Michigan Street, N. W.

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W. H. Schulz Co., Inc.
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Steel Sales & Equipment Co.
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WHAT? . . . An entirely new concept in socket set screws—capable of delivering the highest degree of holding power ever attained . . . is now available! The new P-K® W-POINT provides 30% more back-out torque . . . 50% more resistance to vibration . . . 50% more resistance to rotary slippage!

HOW MUCH ?

HOW MUCH? . . . Not one penny more than conventional set screws. You get all the advantages of this revolutionary improvement in socket set screws—*at no increase in price!*

the new W-POINT SOCKET SET SCREW

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Accurate threads!

Longer tool life!

STANDARD TAPS

Maintain Accuracy to produce Correct Class of Fit because:

Flutes are Automatically Index Ground insuring Uniform Flute Spacing, Flute Contours and Chamfers.

STANDARD'S Surface treatments have been developed to increase tool life when tapping highly abrasive materials.

STANDARD Furnishes Taps specifically designed for use in cast iron, zinc, plastics, aluminum, stainless, and other applications.

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Authorized Distributors Stock-ready for immediate delivery—the COMPLETE FAMILY OF STANDARD QUALITY CUTTING TOOLS,
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Just put it to work ... that's all!

Performance speaks for itself. And if you think there's no difference in hacksaw blades, try this:

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Then you'll know you're getting more for your hacksaw dollar than you ever got before. And then you'll see why so many other hacksaw users "Say Simonds and Save!"

Simonds "Red End" Power Blades come in All-Hard and Shatterproof types in all standard lengths, thicknesses and tooth spacings . . . a "right" blade for every job! Three types of Hand Blades are also furnished in all standard specifications for best results at lowest cost.

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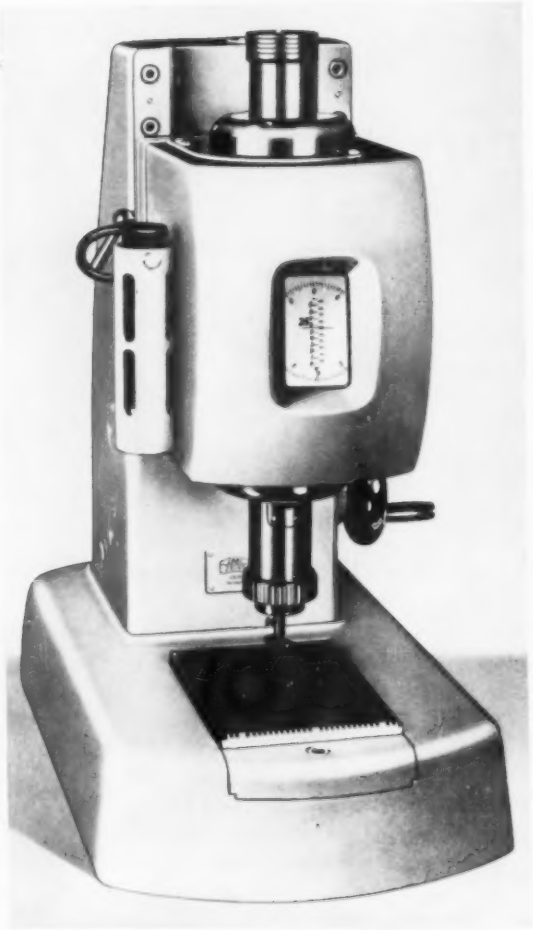
NEW Vertical Metroscope

(BASED ON ABBE'S COMPARATOR PRINCIPLE)



Made in West Germany

Precision Thickness Meter

•

A new mechanical-optical measuring instrument in a form best suited to modern technical requirements. Measurements can be made on the external dimensions of parts with parallel surfaces, cylindrical parts, balls or pieces with spherical surfaces, and threads (pitch diameter by the 3-wire method).

Operator is seated, and his hands do not touch the instrument while measuring—thus it is not subjected to body heat which might affect precise measurements.

Raising or lowering of the measuring spindle and adjustment of reading devices is done by motor drives which are actuated by levers on the right-hand side of the base. Spindle has a 4″ glass scale, the image of which is projected into a 1¾ x 3¼″ window at a magnification of 46x. Easy visibility permits fatigue-free measuring over long periods.

The instrument has a heavy cast base with column for the Abbe measuring unit. Measuring table is $6^{11}/_{16}$ x 5⅛″ and has two working surfaces. One side is grooved for general measuring while the other side has three ribs for gauge-block measurements. Auxiliary tables may be screwed onto the groove side for measuring balls, sheet metal, foil, turned parts with shoulders, etc., and for thread measurements.

Height of measuring unit is adjustable and while in its upper position affords a total working range of 8″.

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. . . feeds instructions to the Kearney & Trecker MILWAUKEE-MATIC with speed and accuracy far beyond human ability. Modern control is just a part of the new MILWAUKEE-MATIC *manufacturing concept* that changes production schedules from Months to Minutes. The MILWAUKEE-MATIC is a complete machining center which unifies milling, drilling, boring, reaming and tapping operations into a single, numerically controlled unit.

Write for complete literature file, or call your local Kearney & Trecker representative today.

Numerical Control Division

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MILWAUKEE ®

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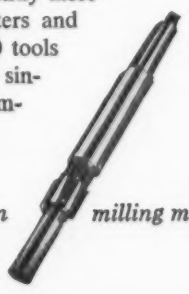
Today O K Tool offers one of the most comprehensive lines of milling cutters in the industry. It consists of many "firsts": the first single-point tools with interchangeable tool bits for lathe, planer, shaper and boring mill jobs; the first milling cutters with tapered and serrated blades; the first shankless single-point tools. Recently these have been supplemented with quick-change wedge-type milling cutters and over 750 kinds and sizes of solid tools, making a total of over 3000 tools designed to better serve machine shops everywhere. Free catalogs: ☐ single point tools, ☐ milling cutters, ☐ solid cutters. The O K Tool Company, Inc., 300 Elm Street, Milford, New Hampshire.

OK *modern milling*  *cutters for*  *modern*  *milling machines*

look man-
NO HANDS!

DRILL PRESSES BECOME AUTOMATIC

with...

DUMORE AUTOMATIC DRILLING UNITS

do all these jobs, and more . . .
TAP • DRILL • REAM • CHAMFER
SPOT-FACE • CENTER • DE-BURR
even in stainless steel

COMPLETELY AUTOMATIC . . . just plug in and they're ready to go . . . all controls built in. Unskilled labor can learn to operate in minutes. Actuation by foot switch leaves both hands free for parts loading, positioning, unloading.

Once set, they're always set with no operator fatigue, slowdowns, or errors—minimizing scrap loss and tool breakage—resulting in lower cost, increased production. Easy, quick control adjustments for fast change-overs from job to job, long or short runs. Capacity from #60 to ⅜" for drilling, or #0-80 to ½"-20 tapping in steel. Automatic woodpeckering control available for chip removal in deep holes. Multiple spindle heads fit on nose of basic unit for simultaneous multi-hole work.

TRY ONE NOW . . .

on your own drill press column, or our's . . . and see the wonderful proof of performance.

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for a demonstration, **now** . . . in your own shop if you like. 3 models to choose from, priced from $565.75, FOB Racine, complete with all components including motor, ready to operate. Factory trained field service and application advice, of course. Complete line of accessories, too!

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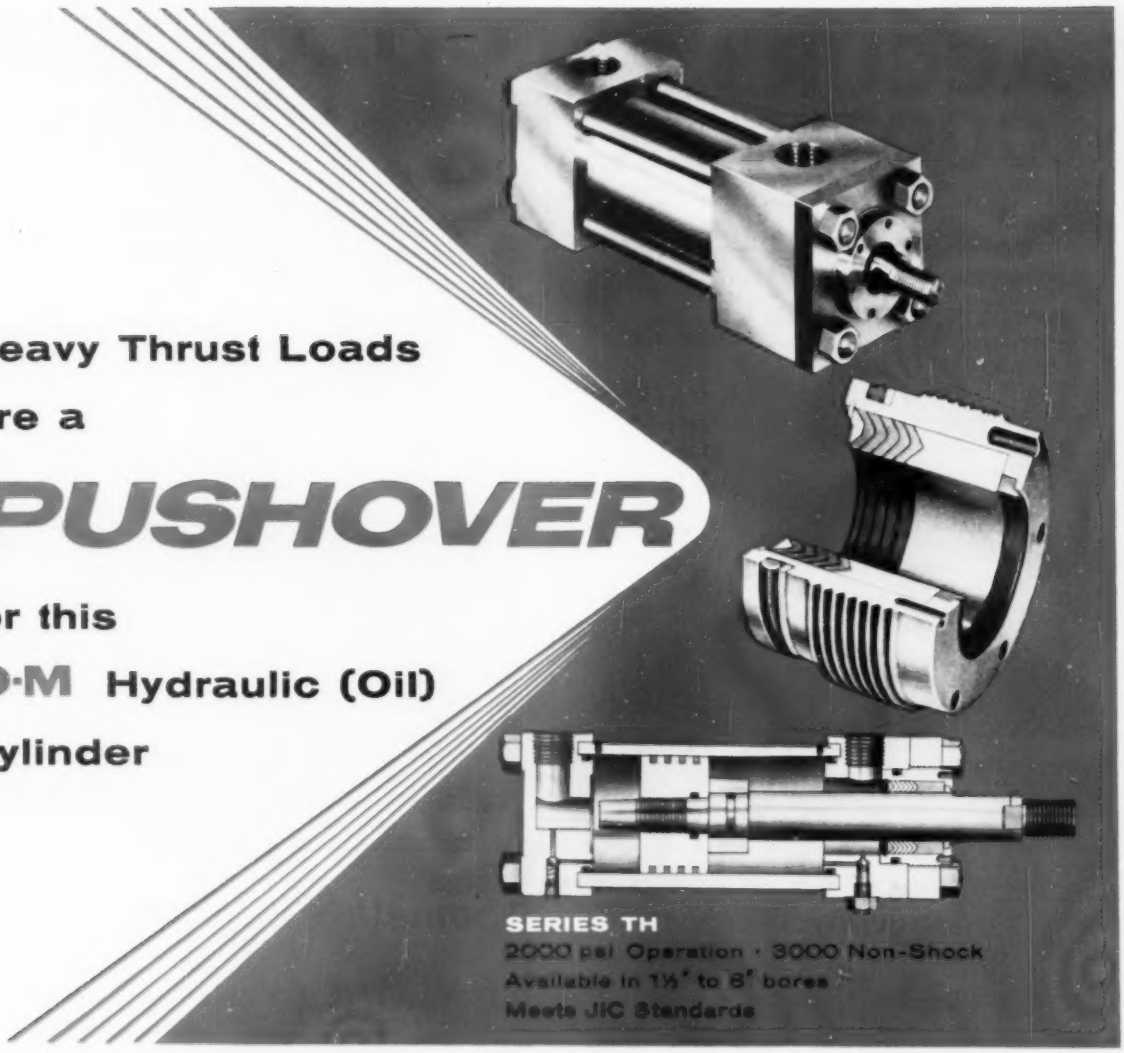

MANY construction, design and engineering advantages contribute to the power-loaded thrusts of this heavy-duty O-M component. It is ruggedly constructed—all steel and bearing bronze. It is designed right to seal right against power loss. The large ports conduct an unrestricted flow of fluid to the piston, assuring full power. Cushion ball check valve provides for full power starts of return strokes.

The tensile steel, chrome-plated, standard or oversize, piston rods have a high yield point for higher load capacity. And the rod gland cartridge, threaded for easy removal, is piloted in rod head to assure perfect alignment undisturbed by heavy load stresses. In most installations, cartridge can be removed without removing mounts or tie-rod nuts. A complete selection of mounts is available.

Detailed information about these and other advancements is contained in our latest Bulletin No. 105. Mail coupon below *TODAY* for your copy or consult your local O-M representative.

ORTMAN-MILLER MACHINE COMPANY
13 143rd Street, Hammond, Indiana

☐ Have representative call
☐ Send Bulletin 105

Name_____ Position_____
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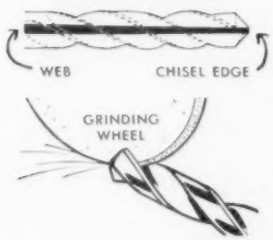
CLIP AND FILE

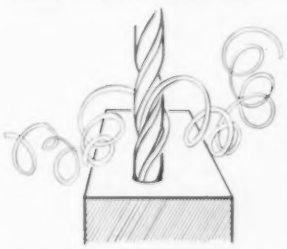
DRILLING TIPS YOU CAN USE

WEB THINNING IS IMPORTANT



The failure to thin the web is a common error in drill repointing. Most drills are made with webs that increase in thickness towards the shank. As the web increases, the length of the chisel edge will also increase if not thinned. Always thin the web to its original thickness, using a machine whenever possible.

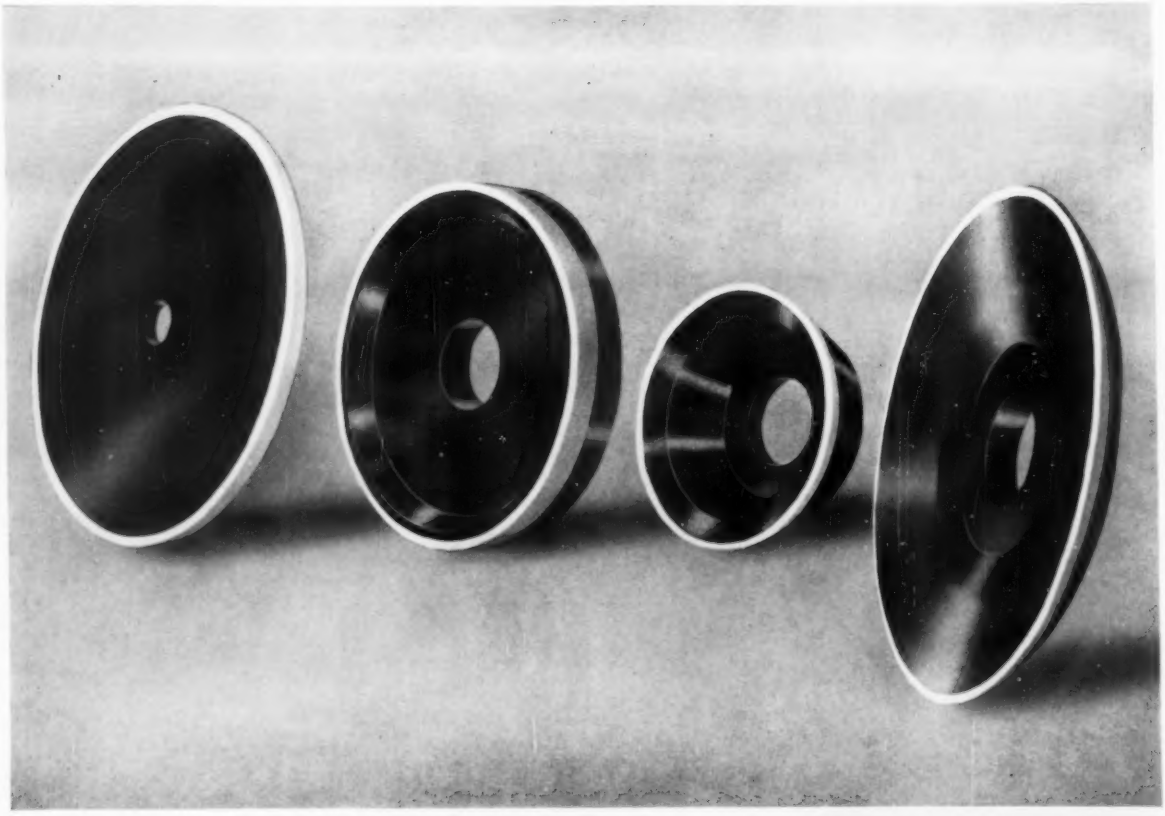
NEED A CHIP BREAKER?



There is a solution to the nuisance and danger of long stringy chips — a common problem in deep hole drilling. It is Chicago-Latrobe's "LO-TORK" Chip Breaker Drill. "LO-TORK" Drills have a radically new flute contour that breaks chips, permits faster feeds, improves lubrication, and lengthens tool life.

GOT A DRILLING PROBLEM?

Arrange a consultation with a Chicago-Latrobe Sales or Service Engineer. His experience in hundreds of plants can lead to a quick solution of your problem.



MANHATTAN DIAMOND WHEELS

Cut Cool and Free—Last Longer

Manhattan Diamond Wheels are engineered to give you faster, cooler cutting and longer life.

Advancements in Diamond Wheel construction and NEW RESINOID BOND developments fully utilize the advantages of both man-made and natural diamond insuring top performance from all Manhattan Diamond Wheels.

TRY Manhattan Diamond Wheels on your toughest application—find out for yourself how they perform in your plant—under your conditions—on your operation.

- New Bonds
- Longer Life
- Bonded for Specific Grinding Requirements
- Natural or Man-made Diamonds

"MORE USE PER DOLLAR"

RM1061

ENGINEERED RUBBER PRODUCTS ..."MORE USE PER DOLLAR"

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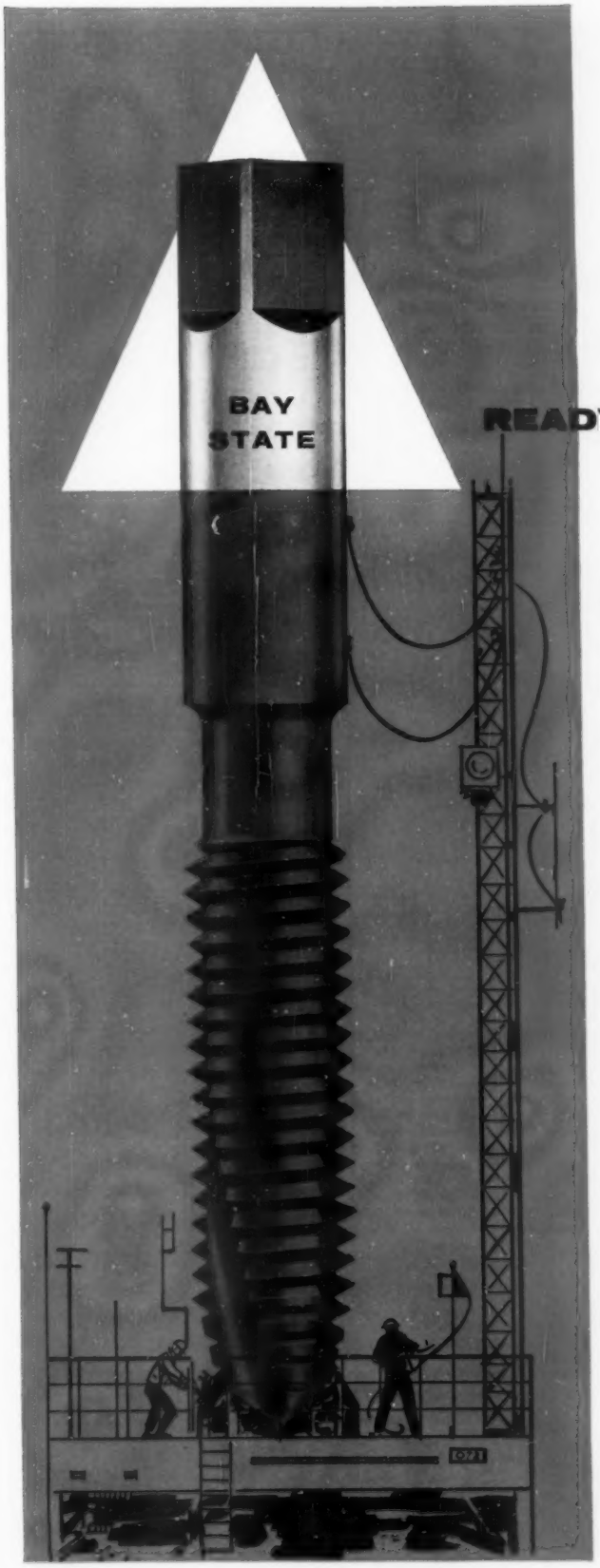
WRITE TO DIAMOND WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION—PASSAIC, N.J.

RAYBESTOS-MANHATTAN, INC.



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A Precision Tapping Performance

Bay State Announces New Sales and Service Facilities

8 New Stockrooms — *strategically located and fully stocked* — provide your distributor with immediate delivery of precision performance Bay State taps.

"Rapid Wire" electronic system assures up-to-the-minute communication between all stockrooms and factory.

Expanded staff of Bay State application engineers — tapping specialists provide undivided attention to your tapping problems.

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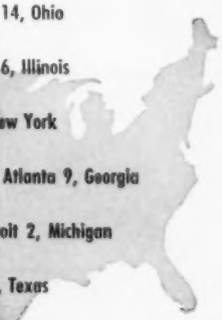
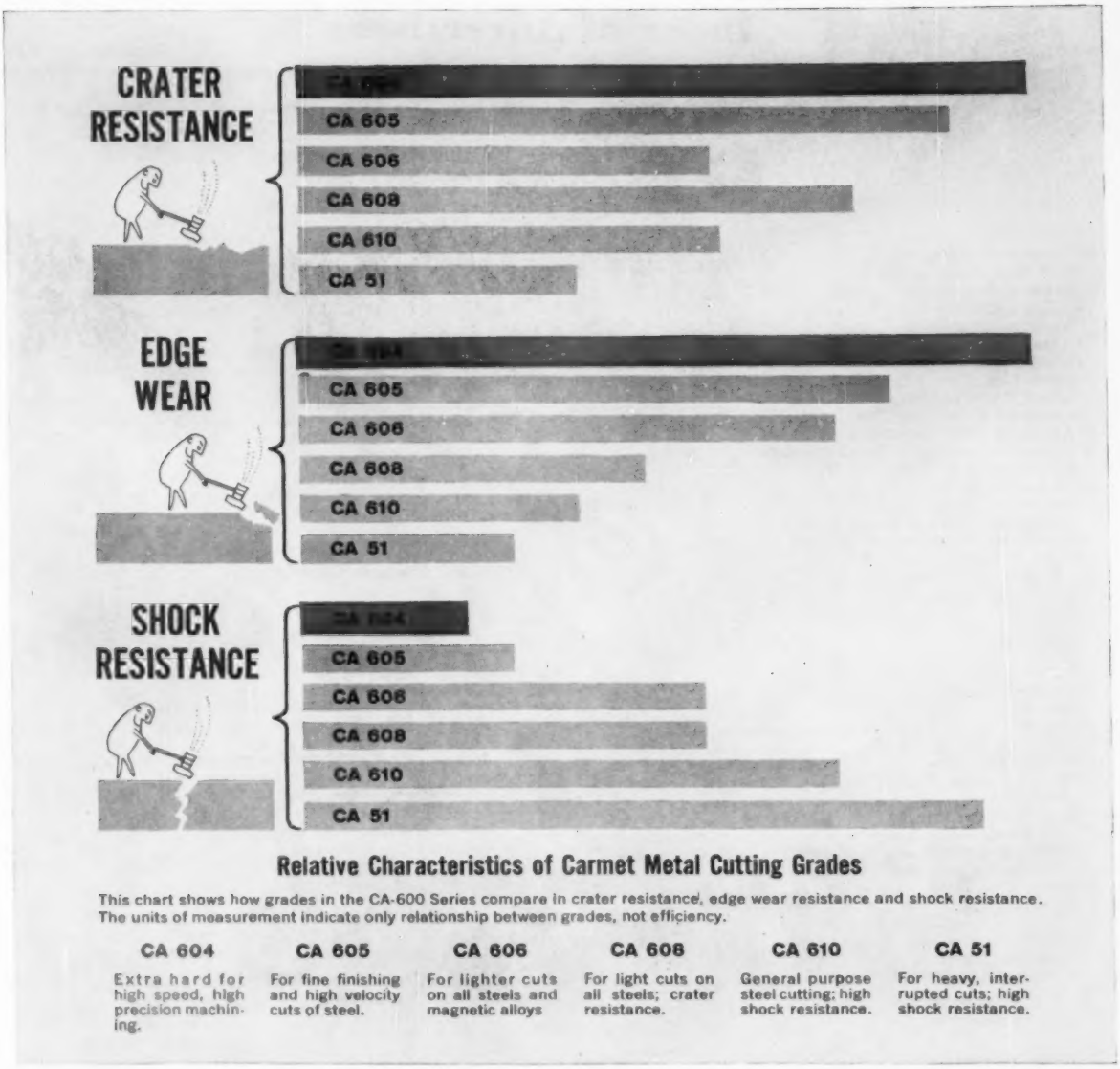


BAY STATE TAPS

Bay State Tap & Die Company • Mansfield, Massachusetts



Relative Characteristics of Carmet Metal Cutting Grades

This chart shows how grades in the CA-600 Series compare in crater resistance, edge wear resistance and shock resistance. The units of measurement indicate only relationship between grades, not efficiency.

CA 604	CA 605	CA 606	CA 608	CA 610	CA 51
Extra hard for high speed, high precision machining.	For fine finishing and high velocity cuts of steel.	For lighter cuts on all steels and magnetic alloys	For light cuts on all steels; crater resistance.	General purpose steel cutting; high shock resistance.	For heavy, interrupted cuts; high shock resistance.

HERE'S THE QUICK STORY ON THE NEW CARMET® CA604

Super-hard cemented carbide designed for today's high-speed, high-precision machining of steel

Product of Allegheny Ludlum research, CA604 is now added to Carmet's crater-resistant 600 series. It is an ultra-hard tungsten carbide with unusually high crater-resistance, wear life and high strength at elevated cutting temperatures. CA604 is an outstanding performer in the fast cutting ceramic areas, combining high velocity finishing with light to medium feeds.

CA604 is offered in Indexable Inserts and Blanks by your Carmet distributor. He carries Carmet standard tools, holders and Indexable Inserts in stock and assures prompt delivery. Call him for help in selecting the proper grades and styles for economical machining—or write *Allegheny Ludlum Steel Corporation, Carmet Division, Detroit 20, Michigan.*

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Write for New-Revised CATALOG C-16-B
CARMET CEMENTED CARBIDES FOR INDUSTRY

This 32-page book contains revised prices and complete specifications on Carmet's full line of cemented carbide tipped tools, blanks and holders. Speed and feed charts, grade comparisons and ordering information included.

ADDRESS DEPT. TE-25

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CEMENTED CARBIDE DIVISION OF
ALLEGHENY LUDLUM STEEL CORPORATION

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Index of Advertisers

January 1960

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LOOKING AHEAD

By T. W. Black
Senior Associate Editor

The steel strike has retarded the machine tool industry's recovery. Production has not yet been affected seriously, according to the Value Line Investment Survey, but the rising trend of new orders has come to a halt.

Looking ahead, the survey estimates that machine tool shipments will rise some 50 percent to $650 million in 1960, and that the cyclical growth of the industry should continue over the next three to five years.

Tool and die manufacturing recovered substantially from the 1958 recession during 1959, according to the National Tool & Die Manufacturers Association. The association predicts substantial gains for the industry in 1960.

This will be a record year for the bearing industry, with shipments up $100 million to about $900 million, says SKF director of marketing Richard S. Overton.

Overton notes a shift in capital expenditures by industry. Capital expenditures in 1955-57 were almost evenly divided between plants and equipment. But the 1959-60 period will see approximately 65 percent of capital spending for replacement and modernization and only 35 percent for expansion.

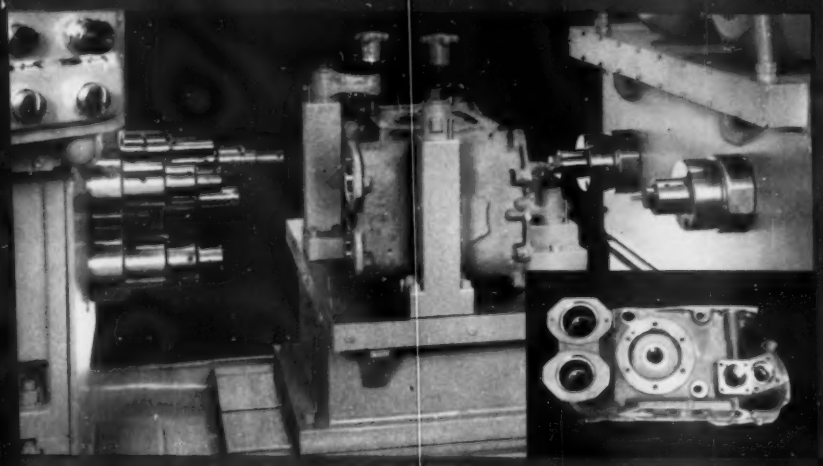
W. A. Meddick, Elwell-Parker president, feels that the steel strike has caused many companies to hold up expected purchases of capital equipment. Thus, he says, 1960 first-quarter business will suffer. Taking a long-range view, Meddick predicts that while the long-heralded boom of the 60's is being severely delayed, sales volume of material handling equipment, a good barometer for industry as a whole, will increase some 60 percent during the next 10 years.

Whatever the business prospects for the next decade, it is already apparent that technological developments in manufacturing methods and materials will come at an accelerating rate.

An example is a new machining process developed by L. R. Industries —machining with electron beams. Work is accomplished by means of a beam of electrons produced by heating a tungsten filament. The electrons are accelerated by a potential of 25,000 to 110,000 volts.

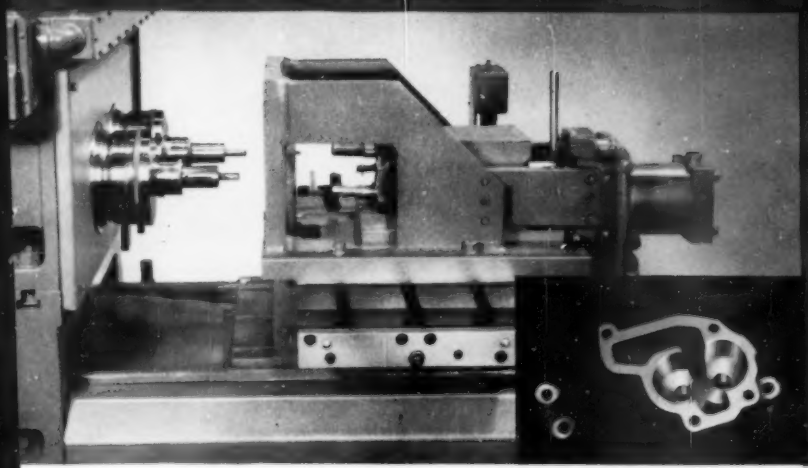
Because of the high energy density, the material at the focus is volatilized. Miniature holes can be cut in virtually all materials, including diamond and carbides. Hole widths can be as small as 40 microns, with a tolerance of plus or minus 5 microns.

Standard Ex-Cell-O Precision Boring Machines



. . . FOR FASTER MULTIPLE-HOLE WORK

Standard style 17-A performs 26 operations in one cycle on a magnesium aircraft casting. Machine bores five bronze bushings, counterbores seven diameters, faces four surfaces and chamfers eight shoulders with five spindles at left, two spindles at right.



. . . FOR FASTER CLOSE-TOLERANCE WORK

Style 312-O finish-bores gear pockets and shaft holes, and plane-faces pocket bottoms of oil pump bodies to tolerance of plus or minus .0005". The faces are square to the bores and parallel to each other within working limits of .001".

39-17

10 REASONS WHY EX-CELL-O PRECISION BORING MACHINES DO MORE, AT LESS COST!

1. RUGGED—Heavily-ribbed base castings, chatter-free hydraulic-actuated table movement, isolated power assembly.

2. FLEXIBLE—Bridges easily spaced-out for large work, moved in for smaller parts.

3. VERSATILE—Inbuilt versatility, plus Universal Fixtures for toolroom work, short-run and production jobs. Spindles mount in any position.

4. FAST—Rapid table traverse, positive spindle brakes and quick-load fixtures for high output.

5. LOW TOOLING COST—Standard machine components, tools and accessories cut lead time, speed setup.

6. AUTOMATIC LUBRICATION—Separate lubricating system pumps oil directly to the ways.

7. SEALED SPINDLES—Ex-Cell-O Precision Spindles permanently lubricated during assembly.

8. CONVENIENT CONTROLS—Easy to use hydraulic controls contained in a single panel.

9. TROUBLE-FREE—Vital machine parts and controls protected from dirt, chips, coolant. Ready access to components for inspection.

10. CAMS FOR CONTOURING—Cam-operated boring machines available for precision contouring work.

Call your local Ex-Cell-O Representative, or write direct for complete details on the full line of Ex-Cell-O Precision Boring Machines.

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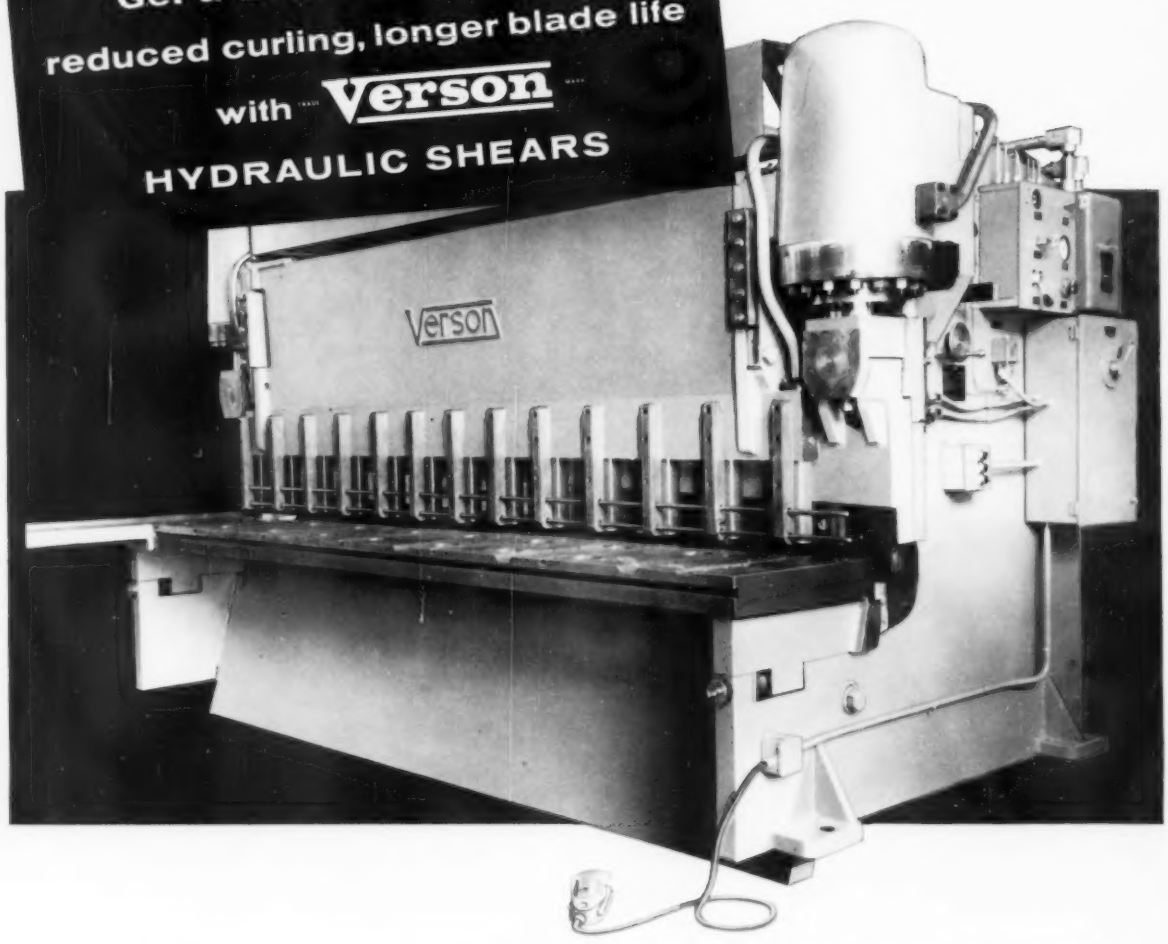
Get a better shear edge, reduced curling, longer blade life with Verson HYDRAULIC SHEARS



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- Power operated, front controlled back gauges
- Front gauge and squaring arm
- Ball transfers in bed for easy stock movement
- Hydro-pneumatic stock hold downs
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Better shearing, more economically—that's what you get with Verson Hydraulic Shears. These rugged units make full use of the advantages of hydraulic power such as reduced shock, constant tonnage and stroke and rake adjustment, plus the advantages of Verson design. Just check the design features listed at the left. Here is your answer to better shear edges on all stock thicknesses up to the machine's capacity.

Verson offers a complete line of hydraulic shears ranging in capacity from 8′ of 3/8″ mild steel to 12′ of 1 1/2″ mild steel. Full details are given in Bulletin No. VHS-59. Write for a copy, today.

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